

## GLOSSARY

**ABIOTIC** – Non-living.

**AERIAL FUELS** – All live and dead vegetation in the forest canopy or above ground fuels, including tree branches, twigs and cones, snags, moss, and high brush.

**ADFLUVIAL FISH** - Fish that spend part of their lives in lakes, ascend rivers and tributaries to spawn, then as adults return to lakes.

**ACTION ALTERNATIVE** - An alternative that proposes some management action, as contrasted to the No Action Alternative.

**ADAPTIVE MANAGEMENT** – A type of natural resource management that implies making decisions as part of an on-going process. Monitoring the results of actions will provide a flow of information that may indicate the need to change a course of action. Scientific findings and the needs of society may also indicate the need to adapt resource management to new information.

**ADMINISTRATIVE APPEAL** - A request to a higher authority for review of a decision related to an environmental impact statement, environmental analysis, or categorical exclusion.

**AFFECTED ENVIRONMENT** - The natural environment that exists at the present time in an area being analyzed and the relationship of people to that environment.

**AGE CLASS**- A distinct group of trees, or portion of growing trees recognized on the basis of age.

**AIRSHED** - Basic geographic units in which air quality is managed.

**ALLELOPATHY** – The reputed influence of one living plant upon another due to secretion of toxic substances.

**ALTERNATIVE** - A combination of management prescriptions applied in specific amounts and locations to achieve a desired management emphasis. One of the several policies, plans or projects, proposed for decision making.

**ANTHROPOGENIC** – Of, relating to, or resulting from the influence of human beings on nature. (e.g. pollution).

**APPROPRIATE MANAGEMENT RESPONSE** - Specific actions taken in response to a wildland fire to implement protection and fire use objectives. Includes control and suppression.

**ASPECT** - The cardinal direction a slope faces. A hillside facing east has an eastern aspect.

**ATV** - Small All Terrain Vehicle, sometimes referred to as a "four-wheeler." See also Off-Road Vehicle.

**AVIAN** – Of, related to, or typical of birds.

**BANK COVER** - Living streamside vegetation overhanging the water for up to 1 meter above the water surface.

**BARK BEETLE** – An insect that bores through the bark of forest trees to eat the inner bark and lay its eggs.

**BEAR MANAGEMENT AREA (BMA)**  
- Areas delineated to include important habitat components and to implement standards and guidelines pertaining to grizzly bears. These areas have also been used for evaluating habitat for other wildlife species including big game and old growth indicator species.

**BERM** – A barrier, such as an earthen mound or concrete structure, placed across a road to permanently restrict the road from use by wheeled motorized vehicles.

**BENEFIT-COST RATIO** - Measure of economic efficiency, computed by

dividing total discounted primary benefits by total discounted economic costs.

**BEST MANAGEMENT PRACTICES (BMPs)** - Methods, measures taken, or practices to prevent or reduce water pollution. Usually BMPs are applied as a system of practices rather than a single practice.

**BIOLOGICAL ASSESSMENT** - A document prepared by a federal agency for the purpose of identifying any endangered species or threatened species that is likely to be affected by an agency action. This document facilitates compliance with the Endangered Species Act. The federal agency, in consultation with the Secretary of Interior, must insure that any action authorized, funded, or carried out by a federal agency is not likely to jeopardize the continued existence of any endangered or threatened species, or result in the destruction or adverse modification of its habitat.

**BIOLOGICAL DIVERSITY (or Biodiversity)** - The variety of life and its processes, including bacteria, fungi, plants, insects, birds, fish and mammals, the genes they contain and the ecosystems they form.

**BIOLOGICAL EVALUATION** - A document prepared by the Forest Service to review programs or activities to determine how an action might affect any threatened, endangered, proposed, or sensitive species. This document often focuses only on sensitive species if the Threatened, Endangered, and Proposed Species will be covered in a Biological Assessment.

**BIOLOGICAL OPINION** – A document that is the product of formal consultation, stating the opinion of the U.S. Fish and Wildlife Service on whether a federal action is likely to jeopardize the continued existence of a listed species or result in the destruction of or adverse modification of critical habitat.

**BIOMASS (FUELS)** – The total mass of living matter in an environment.

**BIOTIC** – Living.

**BMA** – See Bear Management Area.

**BMU SUBUNIT** – See subunit.

**BLOWDOWN (Windthrow)** - Uprooting by the wind. Also refers to a tree or trees so uprooted.

**BOARD FOOT** - A unit of measurement represented by a board 1-foot square and 1 inch thick.

**BOLE** – A tree trunk.

**BROADCAST BURN** - Allowing a prescribed fire to burn over a designated area within well-defined boundaries, for reduction of fuel hazard, as a silvicultural treatment, or both.

**BROWSE** - Twigs, leaves, and young shoots of trees and shrubs on which animal feed; in particular, those shrubs that are used by big game animals for food.

**BUFFER** – A land area designated to block or absorb unwanted effects to the area beyond the buffer and to preserve other qualities along or adjacent to roads, trails, watercourses, and recreation sites.

**BURN OUT** – Setting fire within a control line to widen or consume fuel between the edge of the fire and the control line.

**BURN INTENSITY** – Based on temperature, moisture content of duff, fuels lying on the ground, and heat of combustion of conductive and radiant heat that goes down into the soil, affecting soil characteristics.

**BURN SEVERITY** – A relative measure of the degree of change in a watershed that relates to the intensity of the fire on soil hydrologic function. Burn severity is delineated on topographic maps of polygons. Classes of burn severity are high, moderate, low, and unburned.

**CABLE LOGGING** – Logging that involves the transport of logs from stump to collection points by means of suspended steel cables.

**CAMBIUM** – A thin layer of living cells that lies between the bark and the inner wood of a tree where transportation of nutrients occurs.

**CANOPY** - The part of any group of trees represented by the branches and foliage formed by tree crowns.

**CANOPY COVER or CROWN**

**CLOSURE** - The percentage of ground surface that is shaded by the live foliage of plants as seen from above. Used to describe how open or dense a stand of trees is.

**CAPABILITY** - The potential of an area of land and/or water to produce resources, supply goods and services, and allow resource uses under a specified set of management practices and at a given level of management intensity. Capability depends upon current conditions and site conditions such as climate, slope, landform, soils, and geology; as well as the application of management practices, such as silviculture or protection from fires, insects, and disease.

**CARNIVORE** – A flesh-eating or predatory organism, as a bird of prey, a bear or wolf, or an insectivorous plant.

**CAVITY** - A hollow in a tree that is used by birds or mammals for nesting, denning, roosting, etc.

**CLOSED CANOPY** - The description given to a stand when the crowns of the main level of trees forming the canopy are touching and intermingled so that light cannot reach the forest floor directly.

**COARSE WOODY DEBRIS (CWD)** - Any piece(s) of dead woody material, e.g., dead boles, limbs, and large root masses on the ground or in streams.

**COMMERCIAL THINNING** - A silviculture treatment that 'thins' out an overstocked stand by removing trees,

which are large enough to be sold as products such as poles or fence posts. It is carried out to improve the health and growth rate of the remaining crop trees.

**COMPOSITION (SPECIES)** - The mix of different species that make up a plant or animal community, and their relative abundance.

**CONDITION CLASS** – A function of the degree of departure from historical fire regimes resulting in alterations of key ecosystem components, such as species composition, structural stage, stand age, and canopy closure. Categorized by three classes as follows: Condition Class 1 – Fire regimes are within or near an historical range; Condition Class 2 – Fire regimes have been moderately altered from their historical range; Condition Class 3 – Fire regimes have been significantly altered from their historical range.

**CONIFER** – A tree that produces cones, such as a pine, spruce, or fir tree.

**CONSULTATION** - A process required by Section 7 of the Endangered Species Act whereby federal agencies proposing activities in a listed species habitat confer with the U.S. Fish and Wildlife Service about the impacts of the activity on the species. Consultation may be informal, and thus advisory, or formal, and thus binding.

**CORRIDOR** - A band of vegetation, usually older forest, which serves to connect distinct patches on the landscape. By providing connectivity, corridors permit the movement of plant and animal species between what would otherwise be isolated patches.

**COUNCIL ON ENVIRONMENTAL QUALITY (CEQ)** - An advisory council to the President established by the National Environmental Policy Act of 1969. It reviews Federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

**COVER/FORAGE RATIO** - The ratio of tree cover (usually conifer types) to foraging areas (natural openings, clearcuts, etc.).

**COVER TYPE** - The present vegetation composition of an area, described by the dominant plant species.

**CROWN** - The part of a tree or other woody plant bearing live branches and foliage.

**CROWN CLOSURE** - See Canopy Cover.

**CROWN FIRE** - A fire that advances from top-to-top of trees or shrubs more or less independently of the surface fire. Sometimes, crown fires are classed as either running or dependent, to distinguish the degree of independence from the surface fire.

**CULTURAL RESOURCES** - The physical remains of human activity (artifacts, ruins, burial mounds, petroglyphs, etc.) and conceptual content or context (as a setting for legendary, historic, or prehistoric events; as a sacred area of native peoples, etc.) of an area of prehistoric or historic occupation.

**CUMULATIVE EFFECT** - The impact on the environment, which results from the incremental impact of the action when added to other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time or space.

**DBH** – See Diameter Breast Height.

**DECOMMISSION** – In terms of this document, this term means to change a road so it no longer functions as a road or trail. This can be accomplished through one or a combination of treatments including: recontouring to original slope, placement of natural debris, or revegetation with shrubs or trees. Culvert removals and stream restoration would occur where roads to be decommissioned intersect streams.

**DEDICATED SKID TRAIL** - A trail used repeatedly for skidding logs in order to confine disturbance to that trail only.

**DEFENSIBLE SPACE** - That area between a structure and an oncoming wildfire where the vegetation has been modified to reduce the wildfire threat and to provide an opportunity for firefighters to effectively and safely defend the structure.

**DENSITY (STAND)** - The number of trees growing in a given area, usually expressed in terms of trees per acre.

**DIAMETER BREAST HEIGHT (DBH)** - The diameter of a tree measured four and one-half feet above the ground.

**DIRECT EFFECT** - Effects on the environment that occur at the same time and place as the initial cause or action.

**DISPERSAL** - The movement of organisms away from the place of birth or from centers of population density.

**DISPERSED RECREATION** - That portion of outdoor recreation use which occurs outside of developed sites in the unroaded and roaded forest environment i.e., hunting, backpacking, and berry picking.

**DISPERSED SKID** - Removing logs from a unit where the equipment makes only one or two passes over any given piece of ground to minimize disturbance.

**DISTURBANCE (Ecosystem)** - Refers to events that alter the structure, composition, or function of terrestrial or aquatic habitats. Natural disturbances include, among others, drought, floods, wind, fires, wildlife grazing, and insects and pathogens. Human-caused disturbances include actions such as timber harvest, livestock grazing, roads, and the introduction of exotic species.

**DISTURBANCE REGIME** - Natural pattern of periodic disturbances, such as fire or flooding.

**DIVERSITY** - The distribution and abundance of different plant and animal communities and species.

**DOWNED WOOD (DEBRIS)**

**HABITAT** – Logs and stumps used for a variety of functions for wildlife species, especially mammals and amphibians, for feeding, reproduction, resting, and cover.

**DUFF** - The partially decayed organic matter on the forest floor.

**EARLY-SERAL/STRUCTURAL**

**STAGE** - A stage of development of an ecosystem from a disturbed, relatively unvegetated state to a plant community that is up to about 30 years old. Stand structure is seedling and sapling sized.

**ECOLOGICAL INTEGRITY** - The quality of a natural unmanaged or managed ecosystem in which the natural ecological processes are sustained, with genetic, species and ecosystem diversity assured for the future

**ECOSYSTEM** - A functional unit consisting of all the living organisms (plants, animals, and microbes) in a given area, and all the non-living physical and chemical factors of their environment, linked together through nutrient cycling and energy flow. An ecosystem can be of any size--a log, pond, field, forest, or the earth's biosphere--but it always functions as a whole unit. Ecosystems are commonly described according to the major type of vegetation, for example, forest ecosystem, old-growth ecosystem, or range ecosystem.

**ECOSYSTEM MANAGEMENT** - The use of an ecological approach to achieve productive resource management by blending social, physical, economic and biological needs and values to provide healthy ecosystems.

**ECOTONE** - A zone of transition habitat created by the juxtaposition of distinctly different habitats, and usually exhibiting competition between organisms common to both.

**EDGE** - The outer band of a patch that has an environment significantly different from the interior of the patch.

**EDGE EFFECTS** - Changes in ecological community due to the rapid creation of abrupt edges in large patches of previously undisturbed habitat. For old growth habitat, this is where sun, wind, predators, competitors, etc., can penetrate further into what was previously interior forest.

**EFFICIENCY, ECONOMIC** - The usefulness of inputs (costs) to produce outputs (benefits) and effects when all costs and benefits that can be identified and valued are included in the computations. Economic efficiency is usually measured using present net value, though use of benefit-cost ratios and may sometimes be appropriate.

**ELK HIDING COVER** - Vegetation, primarily trees, capable of hiding 90 percent of an elk seen from a distance of 200 feet or less.

**ENDANGERED SPECIES** - Any species, plant, or animal that is in danger of extinction throughout all or a significant portion of its range. Endangered species are identified by the Secretary of the Interior in accordance with the 1973 Endangered Species Act.

**ENDEMIC** - A species whose natural occurrence is confined to a certain region and whose distribution is relatively limited (vertebrate biology). A population that is at equilibrium or low density (invertebrate biology or pathology).

**ENVIRONMENTAL BASELINE** – Past and present effects of all federal, state, or private actions and other human activities in the action area. The current condition.

**EPIDEMIC (OUTBREAK)** - The rapid spread, growth, and development of pathogen or insect populations that affect large numbers of a host population throughout an area at the same time.

**ESCAPE ROUTE** - A means to access a safety zone.

**EXTIRPATION** - Localized disappearance of a species from an area.

**EXOTIC PLANTS** - In most cases, plants not native to North America.

**FINE FUELS** - Woody or herbaceous plants, live or dead, less than three inches in diameter.

**FINES** - Sediment in streams that is less than 0.25 inches or 6 millimeters in diameter.

**FIRE EXCLUSION** - The disruption of a characteristic pattern of fire intensity and occurrence (primarily through fire suppression).

**FIRE EVENT (Fire occurrence, Fire incidence)** - A single fire or series of fires within an area at a particular time.

**FIRE FREQUENCY** – A general term referring to the recurrence of fire in a given area over time.

**FIRE HAZARD** - The potential fire behavior for a fuel type, regardless of the fuel type's weather-influenced fuel moisture content or its resistance to fire line construction. Assessment is based on physical fuel characteristics, such as fuel arrangement, fuel load, condition of herbaceous vegetation, and presence of elevated fuels.

**FIRE INTENSITY** – Based on temperature, flame length, rate of spread, heat of combustion, and total amount and size of fuel consumed. Accounts for convective heat rising into the atmosphere and fire effects to the overstory.

**FIRE INTENSITY REDUCTION AREA (FIRA)** - FIRAs are areas around or within a community where fuels have been modified to increase protection of the community from wildfire. A FIRA will also reduce the chance of a fire spreading into the wildland from the community. Direct treatment may not occur over the whole area, but fuels are reduced, ladders are removed, and canopy closure is reduced to slow an approaching fire from the wildland. FIRAs provide defensible

space to increase effectiveness of suppression actions and firefighter safety.

**FIRE INTOLERANT (or “intolerant”)** - Species of plants that do not grow well or die from the effects of fire. Generally these species are shade-tolerant as well.

**FIRE MANAGEMENT ZONE (FMZ)** – A geographic area delineated by the “appropriate management response” to a wildland fire. Defined by fuels, topography, values at risk, threats to private property, wilderness boundaries, etc.

**FIRE REGIMES** - The ecological effects of frequency, intensity, extent, season, and synergistic interactions with other disturbances, such as insects and disease, classified into generalized levels of fire severity.

**FIRE RETURN INTERVAL (Fire Interval)** - The number of years between successive fire events in a given area.

**FIRE RISK** - The probability or chance of fire starting determined by the presence and activities of causative agents.

**FIRE ROTATION** – The length of time necessary for an area equal in size to the study area to burn.

**FIRE SEVERITY** – A relative measure of the post-fire appearance of vegetation (residual fuels/mortality) as it relates to the intensity of the fire and its consumptive effects on vegetation.

**FIRE SUPPRESSION (Fire Control)** - All of the work and activities connected with fire extinguishing operations, beginning with discovery and continuing until the fire is completely extinguished.

**FIRE TOLERANT (or “tolerant”)** - Species of plants that can withstand certain frequency and intensity of fire. Generally these species are shade-intolerant as well.

**FIREFIGHTER SAFETY** - A work environment where foreseeable risks have been minimized through the mitigation of

known hazards associated with wildlife suppression.

**FISH HABITAT** - The place where a population of fish species lives and its surroundings; includes the provision of life requirements such food and cover.

**FISH PASSAGE** - Clear access for migrating fish.

**FISHERY** - The total population of fish in a stream or body of water and the physical, chemical, and biological factors affecting that population.

**FOLIAGE** – Plant leaves as a whole.

**FORAGE** - All browse and non-woody plants available to livestock or wildlife for feed.

**FORB** - Any herbaceous (herb-like) plant other than grass or grass-like plants that has little or no wood on it. For example, wildflowers are forbs.

**FOREST HEALTH** - The condition in which forest ecosystems sustain their complexity, diversity, resiliency, and productivity while providing for human needs and values. It is a useful way to communicate about the current condition of the forest, especially with regard to the ability of the ecosystem to respond to disturbances.

**FOREST LAND** - Land at least 10 percent occupied by forest trees of any size or formerly having had such tree cover and not currently developed for non-forest use. Lands developed for non-forest use include areas for crops, improved pasture, residential, or administrative areas, improved constructed roads of any width, and adjoining road clearing and power-line clearing of any width.

**FOREST PLAN** - A Forest Plan is a document prepared under the National Forest Management Act by each national forest that generally describes how the resources in the forest will be managed for a 10-15 year period.

**FOREST STRUCTURE** - The mix and distribution of tree sizes, layers, and ages

in a forest. Some stands are mostly one size (single-story), some are two-story, and some are a mix of trees of different ages and sizes (multi-story).

**FOREST SUPERVISOR** - The official responsible for administering the National Forest System lands in a Forest Service Administrative unit, which may consist of one or more National Forests or all the National Forests within a State.

**FOREST SYSTEM ROAD** - A road wholly or partly within or adjacent to and serving the National Forest System and which is necessary for the protection, administration, and utilization of the National Forest System and the use and developments of its resources.

**FOREST TYPE** - A category of forest usually defined by its vegetation, particularly its dominant vegetation as based on percentage cover of trees, e.g. spruce-subalpine fir; lodgepole.

**FORESTED CONNECTIVITY** - Connectivity for wildlife species that prefer to remain within or close to forested cover.

**FORWARDER** – A machine that picks up cut-to-length logs and transports them from the forest to the roadside or landing.

**FRAGMENTATION** - The alteration of a large habitat patch to create isolated or tenuously connected patches of the original habitat that are interspersed with an extensive mosaic of other habitat types. This results in the reduction of total area, increased isolation of patches, and reduced connectivity between patches of natural vegetation. This occurs naturally through such agents as fire, landslides, windthrow and insect attack. In managed forests, timber harvesting and related activities have been the dominant disturbance agents.

**FSH** - Forest Service Handbook

**FSM** - Forest Service Manual

**FUEL BREAK** - A zone in which fuel quantity has been reduced or altered to

provide a position for suppression forces to make a stand against wildfire. Fuel breaks are designated or constructed before the outbreak of a fire. Fuel breaks may consist of one or a combination of the following: natural barriers, constructed fuel breaks, or man-made barriers.

**FUELS** - Includes living plants, dead, woody vegetative materials; and other vegetative materials that are capable of burning.

**FUEL LOADING** - The oven dry weight of fuels in a given area, usually expressed in tons per acre. Fuel loadings may be referenced to fuel size or time-lag categories; and may include surface fuels or total fuels.

**FUEL MANAGEMENT** - Manipulation or reduction of flammable matter for the purpose of reducing the intensity or rate of spread of a fire, while preserving and enhancing environmental quality.

**FUELS REDUCTION ZONE (FRZ)** - Areas in which continuous high hazard fuels are broken up. They are designed to increase firefighter safety and reduce resistance to fire control efforts. FRZs may be of any size or shape. They may have a higher number of snags, down logs, and canopy closure than other fuels treatment zones. They are recognized as being a significant portion of a complete fuels management program.

**FUEL TREATMENT** - The rearrangement or disposal of natural or activity fuels.

**GEOGRAPHIC INFORMATION SYSTEM (GIS)** - Computer software that provides database and spatial analytic capabilities.

**GOAL** – A concise statement that describes a desired condition to be achieved. It is normally expressed in broad, general terms and is timeless in that it has no specific date that it is to be completed. Goal statements form the principal basis upon which objectives are developed.

**GRADIENT (stream)** - The slope of a streambed.

**GRIZZLY BEAR SUBUNIT** – See subunit.

**GROUND-BASED LOGGING SYSTEM** – Logging equipment such as a tractor or rubber-tired skidder that operates on the ground and is used to remove trees from a cutting area.

**GUIDELINE** - An indication or outline of policy or conduct dealing with the basic management of the Forest. Forest-wide management standards and guidelines apply to all areas of the Forest regardless of the other management prescriptions applied.

**HABITAT TYPE** - An aggregation of all land areas potentially capable of producing similar plant communities over time.

**HAZARD** - A real or potential condition that may result in an undesired event, the cause of risk. Hazard can apply to the probability of tree mortality or damage by an insect or disease and also represents material or fuel that will ignite and burn.

**HERBIVORE** – An animal that feeds on plants.

**HIDING COVER** - Vegetation used by an animal for hiding. The amount and quality of vegetation needed depends on the animal's size, mobility, and reluctance to venture into relatively open areas. For an elk, hiding cover conceals 90% of a standing adult elk from the view of a human at a distance equal to or less than 200 feet. Hiding cover allows elk to use areas for bedding, foraging, thermal relief, wallowing, or other functions, but it does not necessarily provide security during the hunting season.

**HISTORICAL RANGE OF VARIABILITY (HRV)** – The natural fluctuation of components of healthy ecosystems over time. Often refers to the range of conditions and processes that are likely to have occurred prior to settlement

of the project area by people of European descent (approximately the mid-1800s).

**HOME RANGE** - An area, from which intruders may or may not be excluded, to which an individual restricts most of its usual activities.

**HYDROLOGICAL UNIT CODE (HUC)** - A Hydrologic Unit Code (HUC) is part of a coding system developed by the U.S. Geological Service to map geographic boundaries of watersheds of various sizes. The HUCs are called (from larger to smaller) first-, second-, third-, and fourth-field HUCs, etc.; smaller HUCs are nested within larger ones. A subbasin represents a fourth-field HUC, or a unit of approximately 800,000 to a million acres. The ICBEMP also identified two smaller sizes of HUCs, fifth- ("watersheds") and sixth-field ("subwatersheds") HUCs, to aid in analysis and description.

**IMMATURE TIMBER** - Trees or stands that have grown past the regeneration stage, but are not yet mature.

**INCIDENTAL TAKE** – See take.

**INDIRECT EFFECTS** - Secondary effects which occur in locations other than the initial action or significantly later in time.

**INDIVIDUAL TREE SELECTION METHOD** - A cutting method to develop and maintain uneven-aged stands by the removal of selected trees from specified age classes over the entire stand area in order to meet a predetermined goal of age distribution and species in the remaining stand.

**INITIAL ATTACK** - An aggressive suppression action consistent with firefighter and public safety and values to be protected.

**INSTREAM COVER** - Anything in the water that provides protection to fish from predators (including turbulence, debris, logs, and rocks).

**INTENSITY** - Energy release rates; these are physical descriptors of the fire, not its ecological effects. Generally referred to as High, Moderate, or Low intensity.

**INTERDISCIPLINARY TEAM (ID TEAM)** - A group of individuals with different training assembled to solve a problem or perform a task. The team is assembled out of recognition that no one scientific discipline is sufficiently broad to adequately solve the problem. Through interaction, participants bring different points of view to bear on the problem.

**INTERIOR HABITAT** - Forest interior conditions found deep within forests, away from the effect of open areas. Forest interior conditions include particular microclimates found within large forested areas. Interior conditions are achieved at a point where environmental conditions within a patch are no longer influenced by edge effects, such as light intensity, temperature, wind, relative humidity, and snow accumulation and melt. For Western Montana forests, the edge effect is generally felt for a distance equivalent to 2 to 4 times the average tree height into the stand.

**INTERMITTENT STREAM** - A stream which flows only at certain times of the year when it receives water from springs or from some surface source such as melting snow.

**INVASIVE PLANT** - All State and County listed "noxious weeds" are considered invasive plants. Also, other exotic species (not listed by State or Counties as noxious weeds) that can successfully out compete and displace native plant communities.

**INVENTORIED ROADLESS AREA** - An area identified and classified as roadless. These areas were identified during the second Roadless Area Review and Evaluation (RARE II) in 1977.

**ISSUE** - See Public Issue.

**JACKPOT BURN** – A broadcast burning method used to burn concentrations of fuel

where the fuelbed is not continuous. Often used in light fuel accumulations to achieve hazard reduction.

**JUVENILE TROUT** - The fingerling or sub-adult stages (not sexually mature).

**LADDER FUELS** - Fuels that provide vertical continuity between the surface fuels and crown fuels in a forest stand, thus contributing to the ease of torching and crowning.

#### **LAND AND RESOURCE**

**MANAGEMENT PLAN (LRMP)** - A strategic integrated resource plan based on the principles of enhanced public involvement, consideration of all resource values, and resource sustainability.

**LANDSCAPE** - The landforms of a region in the aggregate; the land surface and its associated habitats at scales of many acres to many square miles; a spatially heterogeneous area.

**LANDSCAPE MANAGEMENT** - Creation of landscapes with a distribution of forest conditions for continuous production of desired goods and services and without adverse effects. Considers management on larger spatial scales and longer time frames.

**LANDTYPE** - An inventory map unit with relatively uniform potential for a defined set of land uses. Properties of soils landform, natural vegetation, and bedrock are commonly components of landtype delineation used to evaluate potentials and limitations for land use.

**LARGE WOOD DEBRIS (LWD)** – Large logs and stumps in streams and on land that provide habitat for aquatic and terrestrial organisms and affects stream function.

**LATE-SERIAL/STRUCTURAL STAGE** - A later stage of development of an ecosystem, used in this project to mean a forest stand more than 100 years old but often more than 150 years old. Forested stands are generally 12 to 20+ inches average DBH.

**LEGACIES** – In an ecological context, anything handed down from a predisturbance ecosystem, including green trees, surviving propagules and organisms, dead wood, and certain aspects of soil chemistry and structure. (Perry and Amaranthus 1997).

#### **LETHAL FIRE/LETHAL FIRE**

**REGIME** - Fire that consumes the entire vegetative community (grasses, shrubs, trees. Also see Stand Replacement Fire

**LINKAGE (habitat)** - Linkage zones are combinations of landscape structural factors that allow wildlife to move through, and live within, areas influenced by human actions. A linear habitat patch through which a species must travel to reach habitat more suitable for reproduction and other life-sustaining needs.

**LOW-SEVERITY GROUND FIRE** - A fire with low intensity that primarily scorches tree boles, allowing fire tolerant species to survive.

**MANAGEMENT AREA** - An aggregation of capability areas that have common management direction and may be dispersed over the Forest. Consists of a grouping of capability areas selected through evaluation procedures and used to locate decisions and resolve issues and concerns.

#### **MANAGEMENT INDICATOR**

**SPECIES** - Species identified in a planning process that are used to monitor the effects of planned management activities on viable populations of wildlife and fish including those that are socially or economically important.

**MATURE TIMBER** - Individual trees or stands of trees that in general are at their maximum rate in terms of the physiological processes expressed as height, diameter, and volume growth.

**MBF and MMBF** - Thousand Board Feet and Million Board Feet, respectively.

**MEAN FIRE RETURN INTERVAL (Mean Fire Interval)** – The average of all

fire intervals in a given area over a given time period.

**MESIC** - Moderately moist.

**MID-SERIAL/STRUCTURAL STAGE -**

A stage of development of an ecosystem, used in this project to mean a forested area from approximately 30 to 100 years old. Forested stands are generally 5 to 16 inches average DBH. Stand structure is pole- and sawlog-sized trees.

**MIXING HEIGHT** – Measured from the surface upward, the height to which relatively vigorous mixing (of smoke) occurs due to convection.

**MIXED-SEVERITY FIRE/MIXED SEVERITY FIRE REGIME** - Mixed-severity fire regime areas can experience the full range of fire severities during either a single event or consecutive events. In other words, in a single fire event both low severity (killing few trees) and high severity (killing all trees) in patches of variable sizes. This tends to create complex fine-grained spatial patterns of vegetation conditions across a landscape.

**MOIST SITES (elk)** - An important characteristic of elk habitat consisting of wet meadows, ponds, seeps, and springs, and typically located in more remote, upper-drainage perched sites.

**MONITORING AND EVALUATION -**

The periodic evaluation on a sample basis of Forest Plan management practices to determine how well objectives have been met and how closely management standards have been applied.

**MONTANE** - Of, growing in, or inhabiting mountain areas.

**MOSAIC** – A mix of stand structure and composition caused by disturbance. In the case of wildland fire, fire burns with varying severity and intensity with widely varying fire effects.

**MULTIPLE USE** - The management of public lands and their various resource values so they are used in the combination

that best meets the present and future needs of the public.

**NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)** - An act which encourages productive and enjoyable harmony between man and his environment; promotes efforts to prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; enriches the understanding of the ecological systems and natural resources important to the Nation; and establishes a Council on Environmental Quality.

**NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) PROCESS** - An interdisciplinary process, mandated by NEPA, which concentrates decision making around issues, concerns, alternatives, and the effects of the alternatives on the environment.

**NATIONAL FOREST MANAGEMENT ACT (NFMA)** - A law passed in 1976 as amendments to the Forest and Rangeland Renewable Resources Planning Act that requires the preparation of Regional and Forest plans and the preparation of regulations to guide that development.

**NATIONAL FOREST SYSTEM (NFS)** - All national forest lands reserved or withdrawn from the public domain of the United States, all national forests lands acquired through purchase, exchange, donation, or other means, the national grasslands and land utilization projects administered under Title III.

**NATIONAL WILDERNESS PRESERVATION SYSTEM** - All lands covered by the Wilderness Act and subsequent wilderness designations, irrespective of the department or agency having jurisdiction.

**NATIVE SPECIES** - Species that are indigenous to a region, as opposed to introduced or exotic species.

**NATIVE (NATURAL) SUCCESSION AND DISTURBANCE REGIMES** - The

historic patterns (frequency and extent) of fire, insects, wind, landslides and other natural processes in an area.

**NATURAL RANGE OF**

**VARIABILITY (NRV)** – see Historical Range of Variability

**NATURAL REGENERATION -**

Renewal of a tree crop by natural seeding, sprouting, suckering, or layering.

**NEOTROPICAL MIGRATORY**

**BIRDS** - Migratory bird species that nest in North America and winter in Central or South America or the Caribbean.

**NO-ACTION ALTERNATIVE** - The management direction, activities, outputs, and effects most likely to exist in the future if the current plan would continue unchanged.

**NON-LETHAL FIRE/NON-LETHAL FIRE REGIME** – Fire that primarily consumes surface fuels causing little mortality to overstory trees. See also Low Severity Fire.

**NON-POINT SOURCE POLLUTION -**

Pollution which is induced by natural processes, including precipitation, seepage, percolation, and runoff; and which is not traceable to any discrete or identifiable facility.

**NON-SEROTINOUS** – Cones that open when the seeds ripen, rather than staying closed for one or more years. These cones do not necessarily need heat to open them.

**NOXIOUS WEED** - A legal term, these are exotic plants regulated by law that are aggressive, difficult to manage, and invasive. These species may displace or significantly alter native plant communities.

**OFF-ROAD VEHICLE (ORV)** - Any vehicle capable of being operated off an established road or trail, e.g., motorbikes, four-wheel drives, and snowmobiles. Sometimes referred to as ATV.

**OLD GROWTH ASSOCIATED**

**SPECIES** – Plants, wildlife, and insects that are dependent at some or all stages of

their life cycles upon ecological conditions that are found inside of “old growth” forests.

**OLD GROWTH HABITAT (FOREST)**

- A community of forest vegetation which has reached a late stage of plant succession characterized by a diverse stand structure and composition along with a significant showing of decadence. The stand structure will typically have multi-storied crown heights and variable crown densities. There is a variety of tree sizes and ages ranging from small groups of seedlings and saplings to trees of large diameters exhibiting a wide range of defect and breakage both live and dead, standing and down. The time it takes for a forest stand to develop into old growth condition depends on many local variables such as forest type, habitat type, and climate. Natural chance events involving forces of nature such as weather, insect, disease, fire, and the actions of man also affects the rate of development of old-growth stand conditions.

**OPEN ROAD** – A road with no restrictions on motorized vehicle use.

**OVERMATURE TIMBER** - Individual trees or stands of trees that in general are past their maximum rate in terms of the physiological processes expressed as height, diameter, and volume growth.

**OVERSTORY** - The portion of the trees that form the uppermost canopy layer in a forest of more than one story.

**PATCH** - Areas distinguished from their surroundings by environmental discontinuities, such as a patch of early-seral/structural stage forest surrounded by mid- and late-seral structural stage forest.

**PATCH DYNAMICS** - The change in the distribution of habitat patches in a landscape generated by patterns of disturbance and subsequent patterns of vegetative succession.

**PERENNIAL STREAMS** - Streams that flow continuously throughout most years and whose upper surface generally stands

lower than the water table in the region adjoining the stream.

**PHEROMONE** – A chemical substance secreted by an insect or animal that influences behavior by other members of the same species. Some pheromones attract while others detract. Synthetic chemicals are often used to simulate the natural pheromone, such as pheromones used to draw in beetles to a tree or to repel beetles from a tree.

**PLUME-DOMINATED FIRE** - The power of the fire is greater than the power of the wind in influencing its behavior.

**POLE** - A tree between a sapling and small timber size at least five inches in diameter at breast height but smaller than 8" DBH.

**POLYGON** - A closed figure, like a circle or an irregular shape.

**POOL** - A portion of the stream with reduced current velocity, often with water deeper than the surrounding areas, and which is usable by fish for resting and cover.

**POPULATION** - A group of coexisting (conspecific) individuals that interbreed if they are sexually reproductive.

**POPULATION VIABILITY** – An evaluation that determines if a population will continue to persist. This term applies to both local populations and an entire species.

**POTENTIAL HABITAT (Wildlife)** - Habitat that is likely to be occupied by a wildlife species or group of species, currently or in the near future.

**POTENTIAL VEGETATION GROUP (PVG)** - Groupings of habitat groups on the basis of similarity of general moisture or temperature environment.

**PRE-COMMERCIAL THINNING** - The selective felling, deadening, or removal of trees in a young stand primarily to accelerate diameter increment on the remaining stems, maintain a specific stocking or stand density range,

and improve the vigor and quality of the trees that remain.

**PREFERRED ALTERNATIVE** - The agency's preferred alternative is the alternative which the agency believes would best fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, technical and other factors, and which meets the purpose and need of the NEPA document.

**PRESCRIBED BURNING** - The controlled use of fire to reduce or eliminate the unincorporated organic matter of the forest floor, or low, undesirable vegetation. A written, approved prescribed fire plan must exist, and NEPA requirements must be met, prior to ignition.

**PROJECT AREA** – An area with a defined boundary that encompasses all activities proposed in a particular project.

**PROPOSED ACTION** - The proposed action or proposal exists at that stage in the development of an action when an agency subject to the Act (NEPA) has a goal and is actively preparing to make a decision on one or more alternative means of accomplishing that goal and the effects can be meaningfully evaluated.

**PUBLIC INVOLVEMENT** - A process designed to broaden the information base upon which agency decisions are made by informing the public about Forest Service activities, plans, and decisions, and participation in the planning processes which lead to final decision making.

**PUBLIC ISSUE** - A subject or question of widespread public interest identified through public participation relating to management of National Forest System lands.

**RANGER DISTRICT** – Administrative subdivision of the national forest supervised by a district ranger.

**REACH** - A length of stream channel, lake, or inlet exhibiting, on average, uniform hydraulic properties and morphology.

**REARING HABITAT** - In the case of juvenile westslope cutthroat trout, this is primarily the pool environment in streams.

**RECLAIMED** – See decommission.

**RECORD OF DECISION** - A document separate from but associated with an environmental impact statement that publicly and officially discloses the responsible official's decision on the proposed action.

**RECOVERY PLAN** - A plan that details actions or conditions necessary to promote species recovery, that is, improvement in the status of species listed under the Endangered Species Act to the point at which listing is no longer appropriate. Plans are required for virtually all listed species.

**REFORESTATION** - The renewal of forest cover by seeding, planting, and natural means.

**REGENERATION** - The renewal of a forest, whether by natural or artificial means. This term may also refer to a tree crop itself.

**REHABILITATION (Road)** - The act of maintaining a road and improving drainage features, usually to meet Best Management Practices standards.

**RELEASE** - Freeing a tree or group of trees from more immediate competition by cutting or otherwise eliminating growth that is overtopping or closely surrounding them.

**RESIDENT FISH** - Non-migratory fish species.

**RESILIENT, RESILIENCY** - The ability of a system to respond to disturbances. Resiliency is one of the properties that enable the system to persist in many different states or successional stages.

**RESPONSIBLE LINE OFFICER** - The Forest Service employee who has the authority to select and/or carry out a specific planning action.

**RESTORE, RESTORATION** - The re-creation of a natural or self-sustaining, resilient community or ecosystem, or a movement in that direction.

**RESTRICTED ROAD** - A road on which motorized vehicle use is restricted during the entire non-denning period. The road requires physical obstruction and motorized vehicle use in the non-denning period is legally restricted by order.

**RIPARIAN AREAS** - Areas with distinctive resource values and characteristics that are comprised of an aquatic ecosystem and adjacent upland areas that have direct relationships with the aquatic system. This is considered the horizontal distance of approximately 100 feet from the normal high water line of a stream channel, or from the shoreline of a standing body of water.

**RIPARIAN ECOSYSTEM** - A transition between the aquatic ecosystem and the adjacent upland terrestrial ecosystem. It is identified by soil characteristics and by distinctive vegetative communities that require free or unbounded water.

#### **RIPARIAN HABITAT**

**CONSERVATION AREA (RHCA)** - Portions of watersheds where riparian-dependent resources receive primary emphasis and management activities are subject to specific standards and guidelines. RHCAs were established as INFISH guidelines.

**RIPARIAN LANDTYPE** - Integrated map units of the types of riparian habitats based on topography, substrate materials (i.e. clays or boulders), and associated vegetation.

**RIPARIAN WILDLIFE HABITAT** - Vegetation growing close to a watercourse, lake, swamp, or spring that is generally critical for wildlife cover, fish food organisms, stream nutrients and large organic debris, and for streambank stability.

**RISK** - The probability of a hazard and/or the consequences of that hazard (hazards are undesirable events).

**ROAD DENSITY** – Number of miles in a given area. In this case, it is the number of miles per square mile.

**ROAD MANAGEMENT** - The combination of both traffic management and maintenance management operations. Traffic management is the continuous process of analyzing, controlling, and regulating uses to accomplish National Forest objectives. Maintenance management is the perpetuation of the transportation facility to serve intended management objectives.

**ROAD PRISM** -The area of the ground containing the road surface, cut slope and fill slope.

**ROADLESS AREA** - A National Forest area which (1) is larger than 5000 acres, or if smaller than 5000 acres, contiguous to a designated wilderness or primitive areas; (2) contains no roads; and (3) has been inventoried by the Forest System for possible inclusion in the wilderness preservation system.

**ROADLESS AREA REVIEW & EVALUATION II (RARE II)** - A comprehensive process, instituted in June 1977, to identify roadless and undeveloped land areas in the National Forest System and to develop alternatives for both wilderness and other resource management.

**SAFETY ZONE (SZ)** – SZ are areas that are fuel free zones that are incapable of burning. They afford a very high degree of firefighter safety from advancing wildfire. They can be natural or person made fire resistant areas such as lakes, dirt, gravel or asphalt parking lots, roads, and areas burned to secure line.

**SALVAGE** – Harvest of trees that are dead, dying, or deteriorating due to fire, wind, insect or other damage, or disease.

**SAPLING** - A young tree that is larger than a seedling but smaller than a pole, typically 5 to 25 feet tall.

**SCOPING PROCESS** - An early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to the proposed action. Identifying the significant environmental issues deserving of study and de-emphasizing insignificant issues, narrowing the scope of the environmental impact statement accordingly (Reg. CEQ regulations, 40 CFR 1501.7).

**SECURITY** - The protection inherent in any situation that allows a wildlife species to remain in a defined area despite an increase in stress or disturbance, such as that associated with hunting season. The components of security include vegetation, topography, the size of the blocks of vegetation, road density, distance from roads, intensity of the disturbance, and seasonal timing. See "Elk Hunting Season Security Area".

**SEDIMENT** - Solid material, both mineral and organic, that is in suspension, being transported, or has been moved from its site of origin by air, water, gravity, or ice.

**SEEDLING** - A young tree that has just germinated but has not yet reached sapling size, typically 1 to 5 feet tall.

**SEEDLING/SAPLING** - A size category for forest stands in which trees less five inches in diameter are the predominant vegetation.

**SENSITIVE SPECIES** - Those wildlife and plant species identified by the Regional Forester for which population viability is a concern because of significant current or predicted downward trends in (a) population numbers or density, or (b) habitat capability that would reduce a species' existing distribution.

**SERAL** - A biotic community that is developmental; a transitory stage in an ecologic succession.

**SERAL/STRUCTURAL STAGE** - A stage of development of an ecosystem from a disturbed, relatively unvegetated state to a complex, mature plant community.

**SEROTINOUS** – Late in maturing or blooming. Also refers to cones that stay on a tree without opening for one or more years. Generally it takes heat, such as from a fire, to open.

**SEVERITY** - Refers to the ecological effects of fires, usually on the dominant organisms of the ecosystem, for example a stand dominated by lodgepole pine.

**SHADE-INTOLERANT** - Species of plants that do not grow well or die from the effects of too much shade. Generally these are fire-tolerant species.

**SHADE-TOLERANT** - Species of plants that can develop and grow in the shade of other plants. Generally these are fire-intolerant species.

**SILVICULTURE** - The theory and practice of controlling the establishment, composition, growth, and quality of forest stands in order to achieve the objectives of management.

**SILVICULTURE DIAGNOSIS** - The process of compiling, summarizing, analyzing, and recording of stand data.

**SILVICULTURAL PRESCRIPTION (Detailed)** - A written document that describes management activities needed to implement silvicultural treatment or treatment sequence. The prescription documents the results of the analysis during the diagnosis phase.

**SILVICULTURAL SYSTEMS** - A management process whereby forests are tended, harvested, and replaced, resulting in a forest of distinctive form. It includes all cultural management practices performed during the life of the stand, such as regeneration cutting, thinning, and

use of genetically improved tree seeds and seedlings to achieve multiple resource benefits.

**SITE PREPARATION** - A general term for a variety of activities that remove competing vegetation, slash, and other debris that may inhibit the reforestation effort.

**SITE PRODUCTIVITY** - Production capability of a specific area of land.

**SIZE CLASS** – Intervals of tree diameters used to classify timber. Size classes include: seedling/sapling; pole timber; and sawtimber.

**SKIDDER** – A machine that skids felled trees to the roadside or landing.

**SKIDDING** - Moving logs or felled trees from the stump to a landing, usually with the forward end supported off the ground.

**SKYLINE** – A logging system used to remove trees from steep slopes. Logs are brought upslope on a suspended cable, or skyline. The cable completely or partially supports the weight of the log.

**SLASH** - Tree residue, such as limbs, logs, and tops, left on the ground after logging and other silvicultural operations or accumulating there as a result of storms, fire, or other natural events.

**SNAG** - A standing dead tree, usually greater than five feet in height and six inches in diameter at breast height.

**SOIL PRODUCTIVITY** - The capacity of a soil to produce a specific crop such as fiber and forage, under defined levels of management. It is generally dependent on available soil moisture and nutrients and length of growing season.

**SPATIAL** – Of, relating to, involving, or having the nature of space.

**SPAWNING GRAVEL** - Small gravels (1/4" - 1.0" diameter) in streams grouped in areas of about one square foot or larger with good water circulation through them.

**SPAWNING HABITAT** - Areas of substrate that provide well-oxygenated

and suitable sized gravels for fish spawning.

**SPECIES** - A group of actually or potentially interbreeding populations that are reproductively isolated from all other kinds of organisms.

**SPECIFIED ROAD** - See Forest System Road, above.

**STAGNATION** - A condition where plant growth is markedly reduced or even arrested through, e.g., competition, state of the soil, or disease.

**STAND** - A community of trees or other vegetative growth occupying a specific area and sufficiently uniform in composition (species), age, spatial arrangement, and conditions as to be distinguishable from the other growth on adjoining lands, so forming a silvicultural or management entity.

**STAND MAINTENANCE FIRE (Non-Lethal)** - Fire that emphasizes the survival of the living overstory vegetation.

**STAND REPLACEMENT FIRE** - Fire that emphasizes the destruction of the living overstory vegetation. See also Lethal fire.

**STAND REPLACEMENT FIRE REGIME** - Stand-replacement fire regimes typically occur on lands that experience predominantly lethal fires, with less than 10% of the forested canopy cover remaining after the fire.

#### **STAND-REPLACING**

**DISTURBANCE** - An agent such as fire, blowdown, insect or disease epidemic, or timber harvest, that kills or removes enough trees to result in an early-seral/structural stage condition.

**STANDARDS AND GUIDELINES** - An indication or outline of policy or conduct dealing with the basic management of the Forest. Forest-wide management standards and guidelines apply to all areas of the Forest regardless of the other management prescriptions applied.

**STEM EXCLUSION** - stand development phase where all growing space is occupied, new stems are prevented from successfully invading, and some existing stems die and thus are excluded from the stand.

**STOCKING** - A measure of timber stand density as it relates to the optimum or desired density to achieve a given management objective.

**STREAMSIDE MANAGEMENT ZONE (SMZ)** - An area adjacent to the bank of a stream or body of open water where extra precaution is necessary to carry out forest practices in order to protect bank edges and water quality.

**STRUCTURE** - The various horizontal and vertical physical elements of the forest, including tree size, canopy composition, quantity and quality of deadwood, ephemeral herbaceous species, density of wildlife trees, fungi, age structure, forest height, etc.

**SUBALPINE** - A terrestrial community that generally is found in colder, harsher environments than the montane terrestrial community.

**SUB-BASIN** - A drainage area of approximately 800,000 to 1,000,000 acres.

**SUBSPECIES** - Subpopulations or races within a species that are distinguishable by morphological characteristics and, sometimes, by physiological or behavioral characteristics.

**SUBSTRATE** - Mineral and/or organic material that forms the stream bed (stream bottom).

**SUBUNIT (related to grizzly bears)** - An area approximately the size of an average annual female home range (about 50 mi.<sup>2</sup> in most of this area), generally from ridge top to valley bottom, and including all seasonal habitats.

**SUB-WATERSHED** - A drainage area of approximately 20,000 acres.

**SUCCESSION** - A natural replacement, in time, of one plant community for

another. Conditions of the prior plant community or successional stage create conditions that are favorable for the establishment of the next stage.

**SUCCESSIONAL STAGE** – A stage of development of a plant community as it moves from bare ground to climax. The grass-forb stage of succession precedes the woody-shrub stage.

**SUMMER RANGE** - Land used by wildlife species (specifically big game and/or grizzly bear) during the summer months.

**SYSTEM ROAD** - See Forest System Road, above.

**TAKE OR TAKING (for Threatened or Endangered Species)** – To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct of a listed species of fish or wildlife without special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to a listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering.

**TEMPORAL** – Related to, concerned with, or limited by time.

**TEMPORARY ROAD** - A road constructed to facilitate forest management activities that is reclaimed soon after the activity is completed.

**TERMS AND CONDITIONS (for Threatened or Endangered Species)** – Requirements of the U.S. Fish and Wildlife Service to implement reasonable and prudent measures that exempt the Forest Service from prohibitions of section 9 of the Endangered Species Act. Reasonable and prudent measures concerning road access may include

regulating the density of open roads, total motorized access routes, maintaining or creating core areas, and public information.

**TERRITORY** - Any area defended by one or more individuals against intrusion by others of the same or different species.

**THERMAL COVER** - Cover used by animals to ameliorate the chilling effects of winter weather or the heating effects of summer weather. For elk, a stand of coniferous trees 40 feet or taller with an average crown closure of 70% or more. Shading and wind breaking

**THREATENED SPECIES** - Any species, plant or animal, which is likely to become an endangered species within the foreseeable future throughout all, or a significant portion, of its range. Threatened species are identified by the Secretary of the Interior in accordance with the 1973 Endangered Species Act.

**TIERING** - Refers to the elimination of repetitive discussions of the same issue by incorporating by reference the general discussion in an environmental impact statement of broader scope. For example, a project environmental assessment could be tiered to the Forest Plan EIS.

**TRAILHEAD** – The parking, signing, and other facilities available at the terminus of a trail.

**TRAVEL HABITAT** - Habitat used by a wildlife species for daily or periodic movements between areas of higher-quality habitat. For example, for a lynx this would be the forested cover used while traveling between areas used for denning and that used for hunting.

**TREATMENT** – Specific to this project, this term relates to a wide variety of management actions.

**UNDERBURNING** - A fire that consumes surface fuels but not trees and large shrubs. See also Low Severity Fire and Stand Maintenance Fire.

**UNDERSTORY** - The trees and other woody species which grow under a more or less continuous cover of branches and foliage formed collectively by the upper portion of adjacent trees and other woody growth.

**UNGULATE** - A mammal with hooves.

**VEGETATIVE SCREENING** - Vegetation (trees, shrubs, etc.) that ameliorates the visual effect of management activities adjacent to viewing areas (i.e. main roads).

**VEGETATIVE SUCCESSION** - A phase in the gradual supplanting of one community of plants by another.

**VERTICAL DIVERSITY** - The distribution and abundance of different plant and animal communities and species on the vertical plane within an area.

**VIABILITY** - A viable animal or plant species is defined as consisting of self-sustaining populations that are well distributed throughout the species' range. Self-sustaining populations are those that are sufficiently large, and have sufficient genetic diversity to display the array of life history strategies and forms that will provide for their persistence and adaptability in the planning area over time.

**VISUAL RESOURCE** - The composite of basic terrain, geologic features, water features, vegetative patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for visitors.

**WATER QUALITY** - The physical, chemical, and biological properties of water.

**WATER YIELD** - The runoff from a watershed, including groundwater outflow.

**WATERSHED** - The land area drained by a river system.

**WATERSHED RESPONSE** - A qualitative degree and/or modeled measure of how a watershed will respond

to precipitation. Parameters include pre-existing soil moisture; amount of soil cover; amount and distribution of impermeable surfaces (rock outcrop, hydrophobic soils); amount and duration of rainfall; lag time between initiation of storm and peak flow runoff; and peak flow discharge and sediment yield. Changes in the characteristics of a watershed brought about by a fire will increase the efficiency with which a watershed yields runoff.

**WETLAND** - Areas that are permanently wet or are intermittently covered with water.

**WILDERNESS** - Federal land retaining its primeval character and influence without permanent improvements or human habitation as defined under the 1964 Wilderness Act. It is protected and managed so as to preserve its natural conditions which (1) generally appear to have been affected primarily by forces of nature with the imprint of man's activity substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and confined type of recreation; (3) has at least 5000 acres or is of sufficient size to make practical its preservation, enjoyment, and use in an unimpaired condition, and (4) may contain features of scientific, educational, scenic, or historical value as well as ecologic and geologic interest.

**WILDFIRE** - An unwanted wildland fire that requires a suppression response.

**WILDLAND FIRE** - A non-structure fire, other than prescribed fire, that occurs in the wildland. Any fire originating from an unplanned ignition.

**WILDLAND-RESIDENTIAL INTERFACE** - That line, area, or zone where structures and other human development meet or intermingles with undeveloped wildland or vegetative fuels.

**WIND-DOMINATED FIRE** - The power of the wind is greater than the power of the fire in influencing its behavior.

**WINDFIRM** - A tree (live or dead) or species of tree that is relatively resistant to being blown over by the wind.

**WINDTHROW** - A tree or stand of trees that have been blown over by the wind.

**WINTER RANGE** - The areas available to and used by big game during the winter season. Must contain forage or browse to feed big game. Winter range areas tend to have a relatively low amount of snow cover which enables the animals to reach the forage.

**YARDING** - The operation of hauling timber from the stump to a collecting point. this is commonly done using a cable system, dozers, helicopters, or rubber-tired skidders.

## Acronyms used in the Final Environmental Impact Statement

The following list of acronyms may be useful in reviewing this document:

<b>A19</b>	Amendment 19	<b>ICBEMP</b>	Interior Columbia Basin Ecosystem Management Project
<b>BA</b>	Biological Assessment		
<b>BAER</b>	Burned Area Emergency Rehabilitation	<b>ID Team</b>	Interdisciplinary Team
<b>BMA</b>	Bear Management Analysis Area	<b>INFISH</b>	Inland Native Fish Strategy
<b>BMPs</b>	Best Management Practices	<b>L</b>	Larch
<b>BMU</b>	Bear Management Unit	<b>LAU</b>	Lynx Analysis Unit
<b>CEQ</b>	Council for Environmental Quality	<b>LP</b>	Lodgepole Pine
<b>CFR</b>	Code of Federal Regulations	<b>LRMP</b>	Land and Resource Management Plan
<b>CWD</b>	Coarse Woody Debris	<b>LWD</b>	Large Woody Debris
<b>DBH</b>	Diameter at Breast Height	<b>MA</b>	Management Area
<b>DEIS</b>	Draft Environmental Impact Statement	<b>MBF</b>	Thousand Board Feet
<b>DEQ</b>	Department of Environmental Quality	<b>MDFWP</b>	Montana Dept. of Fish, Wildlife, and Parks
<b>DF</b>	Douglas-fir	<b>MIS</b>	Management Indicator Species
<b>DNRC</b>	Department of Natural Resources and Conservation	<b>MMBF</b>	Million Board Feet
<b>EAWS</b>	Ecosystem Analysis at the Watershed Scale	<b>NEPA</b>	National Environmental Policy Act
<b>ECA</b>	Equivalent Clearcut Acres	<b>NFMA</b>	National Forest Management Act
<b>EIS</b>	Environmental Impact Statement	<b>PM</b>	Particulate Matter
<b>ESA</b>	Endangered Species Act	<b>PVT</b>	Potential Vegetation Types
<b>FRZ</b>	Fuel Reduction Zone	<b>RHCA</b>	Riparian Habitat Conservation Areas
<b>FS</b>	Forest Service	<b>RMO</b>	Riparian Management Objectives
<b>FSH</b>	Forest Service Handbook	<b>RSI</b>	Ripple Stability Index
<b>FSM</b>	Forest Service Manual	<b>S</b>	Spruce
<b>GIS</b>	Geographic Information System	<b>SAF</b>	Subalpine Fir
<b>HAU</b>	Habitat Analysis Unit	<b>SIL</b>	Scenic Integrity Levels
<b>HE</b>	Habitat Effectiveness	<b>SMZ</b>	Streamside Management Zone

<b>SWCP</b>	Soil Water Conservation Practices
<b>TMDL</b>	Total Maximum Daily Loads
<b>TPA</b>	Trees per Acre
<b>USC</b>	United States Code
<b>USFWS</b>	United States Fish and Wildlife Service
<b>VQOs</b>	Visual Quality Objectives
<b>WATSED</b>	Water & Sediment Yields (Model)
<b>WBP</b>	Whitebark Pine
<b>WL</b>	Western Larch
<b>WEPP</b>	Water Erosion Prediction Project (Model)
<b>WP</b>	White Pine
<b>WRA</b>	Weed Risk Assessment

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## **Appendix A: Flathead and Kootenai National Forest Rehabilitation Act H.R.2691**

Department of the Interior and Related Agencies Appropriations Act, 2004 (Enrolled as Agreed to or Passed by Both House and Senate)

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### ***TITLE IV--THE FLATHEAD AND KOOTENAI NATIONAL FOREST REHABILITATION ACT***

SEC. 401. SHORT TITLE. This title may be cited as the 'Flathead and Kootenai National Forest Rehabilitation Act of 2003'.

SEC. 402. FINDINGS AND PURPOSE. (a) FINDINGS- Congress finds that--

(1) the Robert Fire and Wedge Fire of 2003 caused extensive resource damage in the Flathead National Forest ;

(2) the fires of 2000 caused extensive resource damage on the Kootenai National Forest and implementation of rehabilitation and recovery projects developed by the agency for the Forest is critical;

(3) the environmental planning and analysis to restore areas affected by the Robert Fire and Wedge Fire will be completed through a collaborative community process;

(4) the rehabilitation of burned areas needs to be completed in a timely manner in order to reduce the long-term environmental impacts; and

(5) wildlife and watershed resource values will be maintained in areas affected by the Robert Fire and Wedge Fire while exempting the rehabilitation effort from certain applications of the National Environmental Policy Act (NEPA) and the Clean Water Act (CWA).

(b) The purpose of this title is to accomplish in a collaborative environment, the planning and rehabilitation of the Robert Fire and Wedge Fire and to ensure timely implementation of recovery and rehabilitation projects on the Kootenai National Forest .

SEC. 403. REHABILITATION PROJECTS. (a) IN GENERAL- The Secretary of Agriculture (in this title referred to as the 'Secretary') may conduct projects that the Secretary determines are necessary to rehabilitate and restore, and may conduct salvage harvests on, National Forest System lands in the North Fork drainage on the Flathead National Forest , as generally depicted on a map entitled 'North Fork Drainage' which shall be on file and available for public inspection in the Office of Chief, Forest Service, Washington, D.C.

(b) Procedure-

(1) IN GENERAL- Except as otherwise provided by this title, the Secretary shall conduct projects under this title in accordance with--

(A) the National Environmental Policy Act (42 U.S.C. 4321 et seq.); and

(B) other applicable laws.

(2) ENVIRONMENTAL ASSESSMENT OR IMPACT STATEMENT- If an environmental assessment or an environmental impact statement (pursuant to section 102(2) of the National Environmental Policy Act (42 U.S.C. 4332(2))) is required for a project under this title, the

Secretary shall not be required to study, develop, or describe any alternative to the proposed agency action in the environmental assessment or the environmental impact statement.

(3) PUBLIC COLLABORATION- To encourage meaningful participation during preparation of a project under this title, the Secretary shall facilitate collaboration among the State of Montana, local governments, and Indian tribes, and participation of interested persons, during the preparation of each project in a manner consistent with the Implementation Plan for the 10-year Comprehensive Strategy of a Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment, dated May 2002, which was developed pursuant to the conference report for the Department of the Interior and Related Agencies Appropriations Act, 2001 (House Report 106-646).

(4) COMPLIANCE WITH CLEAN WATER ACT- Consistent with the Clean Water Act (33 U.S.C. 1251 et seq.) and Montana Code 75-5-703(10)(b), the Secretary is not prohibited from implementing projects under this title due to the lack of a Total Maximum Daily Load as provided for under section 303(d) of the Clean Water Act (33 U.S.C. 1313(d)), except that the Secretary shall comply with any best management practices required by the State of Montana.

(5) ENDANGERED SPECIES ACT CONSULTATION- If a consultation is required under section 7 of the Endangered Species Act (16 U.S.C. 1536) for a project under this title, the Secretary of the Interior shall expedite and give precedence to such consultation over any similar requests for consultation by the Secretary.

(6) ADMINISTRATIVE APPEALS- Section 322 of the Department of the Interior and Related Agencies Appropriations Act, 1993 (Public Law 102-381; 16 U.S.C. 1612 note) and section 215 of title 36, Code of Federal Regulations shall apply to projects under this title.

SEC. 404. CONTRACTING AND COOPERATIVE AGREEMENTS. (a) IN GENERAL- Notwithstanding chapter 63 of title 31, United States Code, the Secretary may enter into contract or cooperative agreements to carry out a project under this title.

(b) EXEMPTION- Notwithstanding any other provisions of law, the Secretary may limit competition for a contract or a cooperative agreement under subsection (a).

SEC. 405. MONITORING REQUIREMENTS. (a) IN GENERAL- The Secretary shall establish a multiparty monitoring group consisting of a representative number of interested parties, as determined by the Secretary, to monitor the performance and effectiveness of projects conducted under this title.

(b) REPORTING REQUIREMENTS- The multiparty monitoring group shall prepare annually a report to the Secretary on the progress of the projects conducted under this title in rehabilitating and restoring the North Fork drainage. The Secretary shall submit the report to the Senate Subcommittee on Interior Appropriations of the Senate Committee on Appropriations.

SEC. 406. SUNSET. The authority for the Secretary to issue a decision to carry out a project under this title shall expire 5 years from the date of enactment.

SEC. 407. IMPLEMENTATION OF RECORDS OF DECISION. The Secretary of Agriculture shall publish new information regarding forest wide estimates of old growth from volume 103 of the administrative record in the case captioned Ecology Center v. Castaneda, CV-02-200-M-DWM (D. Mont.) for public comment for a 30-day period. The Secretary shall review any comments received during the comment period and decide whether to modify the Records of Decision (hereinafter referred to as the 'ROD's') for the Pinkham, White Pine, Kelsey-Beaver, Gold/Boulder/Sullivan, and Pink Stone projects on the Kootenai National Forest. The ROD's, whether modified or not, shall not be deemed arbitrary and capricious

under the NFMA, NEPA or other applicable law as long as each project area retains 10 percent designated old growth below 5,500 feet elevation in third order watersheds in which the project is located as specified in the forest plan.

This Act may be cited as the 'Department of the Interior and Related Agencies Appropriations Act, 2004'.

Speaker of the House of Representatives.

Vice President of the United States and

President of the Senate.

Appendix B: Robert -Wedge Project Post-Fire Mortality Analysis and Guidelines

## Introduction

This report documents the study and evaluation of post-fire mortality in the conifer species affected by the Robert and Wedge fires, resulting in a set of criteria to aid in predicting which trees may or may not survive the direct and indirect effects of the fires. It relies on information from numerous research publications; guidelines developed for other post fire projects; professional experience and observations by fire and vegetation managers on this forest; and integration of the site specific conditions in the area and the purpose and need for the project.

Post fire mortality prediction is more of an educated and informed judgment, rather than an exact science. As a whole, insufficient data exist to develop truly accurate estimates of post-fire survival for most conifers (FHP 2000, Weatherby *et al.* 2001). Survival of trees on either extreme of the fire injury spectrum – those most severely burned and those with little injury – is obviously easier to predict than those with variable degrees and kinds of fire injury. Though we may not have complete certainty, we can reliably estimate the likelihood of mortality based on parameters that we can measure and observe.

## Factors affecting tree survival after fire

Coniferous tree species vary widely in their resistance to fire injury. Factors influencing fire tolerance include:

- Bark thickness and character
- Branching habit as it affects crown openness and height of the lowest branches
- Flammability of the foliage
- Characteristics and protection of the buds
- Depth of rooting system

Though these characteristics affect a tree's resistance to injury, there is no conclusive evidence that the likelihood of mortality differs between trees with the same relative level of injury (Ryan and Reinhardt 1988). Once fire injures a tree, a complex of factors determines whether the tree survives or not. These include the tree's pre-fire physiological condition; the type and extent of injury; time of the fire in relation to growing season; site productivity; weather in the years following the fire; a host of potentially damaging biotic agents such as bark beetles and fungi; and interactions between all of them (FHP 2000, Weatherby *et al.* 2001, Scott *et al.* 1996, Ryan and Reinhardt 1988). For example, smaller, immature but vigorous trees sometimes have a better chance of surviving a given proportion of crown injury than older, slower-growing trees because of their greater ability to recover (Ryan 1990). Presence of multiple stresses on trees, such as drought, mechanical damage, insects/pathogens (particularly root disease in DF), reduce the relative ability of trees to survive fire injury. Some species (particularly Douglas-fir and Engelmann spruce) are very susceptible to beetle attack after fire, though it is not always clear what the relationship of insects to fire injury really is (Furniss 1965, Ryan & Reinhardt 1988, Amman & Ryan 1991, Scott *et al.* 1996, FHP 2000, Weatherby 2001).

Primary variables explored in the research literature and shown to have substantial influence on tree survival following wildfire are crown scorch/kill and bole damage. These more readily measurable variables will be the main factors focused on in these guidelines. Damage to root systems of trees (i.e. the coarse and fine “feeder” roots near the surface of the soil) also contributes to tree mortality; however, effects on roots have only been partially studied in the literature, and from a practical standpoint it is very difficult to directly measure in the field (Scott *et al.* 1996). Possible root injury will be considered as one of the additional influencing factors in these guidelines.

Techniques for determining crown kill include using binoculars to check naked eye impressions; observing on clear days and viewing from the side on which the sun is shining if possible. The lee side of the crown (relative to the direction of the fire run) is sometimes the less damaged.

Percentage of live crown related to total tree height is used in this situation at the planning, implementation, contract administration and monitoring stages, because it is often very difficult to determine what the original live crown length actually was (pers. comm. Kamp, 2002). Volume estimates of live crown is often cited in the research literature, rather than the linear estimate described above. However, observing and calculating a linear estimate of crown damage is an easier and more accurate measurement for broad scale practical application of these guidelines at the project level. It is similar to volume estimates, and in any case a linear estimate is more conservative than a volume estimate because of the conical shape of a typical tree crown, with the disproportionate share of volume located in the lower portions of the crown. However, the relative loss of photosynthetic production due to crown kill is not a 1:1 ratio to the percentage of crown killed, because of the greater photosynthetic efficiency of the upper portions of the tree crown as compared to the lower crown (Wyant 1981). Live crown ratios will be used for this project (see tables below).

In the absence of other injury, low percentages of crown kill (i.e. < 30) are not usually considered serious (Ryan 1982, Ryan *et al.* 1988). A crown kill greater than 70%, however, usually causes substantial physiological stress and it is likely that the tree will die within five years (Weatherby *et al.* 2001, Ryan 1982, 1988). Survival rates can vary widely, because many interrelated factors ultimately influence individual tree survival. This includes but is not limited to the degree of other fire injury to the tree; its susceptibility to insect and pathogens; individual tree characteristics such as vigor and size; and various abiotic factors, such as weather and site productivity (Ryan and Reinhardt 1988, Scott *et al.* 1996).

#### **Bole/root crown damage (% of the bole/root crown circumference killed by fire):**

The primary factors controlling the likelihood of bole injury are the fire’s duration and the tree’s bark thickness (Ryan 1990). Older trees of thick barked species (Douglas-fir, larch and ponderosa pine) have the greatest resistance and can withstand longer duration and hotter fire intensities. Thin-barked species (spruce, subalpine fir and lodgepole pine) are much more susceptible to cambial damage and mortality with even low intensity fire, where the crown of the tree may have suffered little or no scorch.

Some quantification of the relationship of actual measured cambium injury on tree survival has been documented, but it is limited (Wagener 1961, Ryan *et al.* 1988). Computed bark thickness (as related to tree species and diameter) and the degree of char on the bole are more often used as a predictor of tree mortality, because they are more readily observed and measured (Ryan & Reinhardt 1988). As indirect measures of cambial damage, they are more subject to error and thus should be used cautiously. But they have been successfully used as

mortality indicators (Wagener 1961, Peterson 1984, Ryan & Reinhardt 1988, Scott *et al.* 1996, Weatherby 2001).

Mortality from bole injury is often not apparent immediately or even one year after the fire (Weatherby *et al.* 2001). Water from the root system may still be able to be transported through xylem tissue up to the foliage, allowing photosynthesis to continue. However, with the dead cambium, phloem carbohydrates cannot be transported from the foliage back down to the roots, and the tree will soon die from lack of nourishment. In addition, it may take several years for thick bark over killed cambium to slough off and underlying damage to be apparent (Ryan 1982). Mortality associated with bole and root damage may result from a combination of factors, including direct fire injury, decay/mechanical weakness, and predisposition to insects.

Damage to the cambium of the stem or root crown is directly determined by chopping through the bark and into the cambium at four points (quadrants) around the bole of the tree. Dead cambium is typically dry and discolored or darkened, versus live cambium, which will be moist to the touch and usually a light, milky white or pinkish/tan in color. Resin flow from bark or exposed wood between the bark and cambium can be an indicator as well (Wagener 1961, Ryan 1982). It helps to know that damage is ordinarily heaviest on the lee side of the tree and on the uphill side, and that killed patches of cambium are usually widest just above ground level and taper upward.

Noting the appearance of the blackened, charred bole can provide an indirect measure. Deep damage to the stem is typically characterized by bark that is deeply charred around the base and lower bole (but not necessarily to the wood) and by bark that has largely lost its surface characteristics. Additional signs include: loss of bark color within the deep fissures of older trees; portions of the bark burned off; and bole scorch running high in the tree. In addition, the condition of the soil, duff and organic layers, and the large fuels burned, at the base of the tree are good indicators. This indirectly indicates the intensity of the fire that likely occurred at that spot, and thus the possible damage to roots and root crowns that may have occurred. Following a visual inspection with chopping through the bark to verify cambium damage is an effective method for calibration and making field determinations.

Tree species and diameter/bark thickness must be considered along with the visual indicators listed above. For example, thick barked trees can show bark charring but still have live cambium underneath. Thin barked species, such as spruce or subalpine fir, may have dead cambium under relatively lightly charred bark.

Consideration of fire damage to the root crown and visible surface roots is part of this evaluation of cambial damage. Severe root damage from surface fire can occur in Douglas-fir, which often develop large, lateral roots close to and above the soil surface. Though the bark on the bole of Douglas-fir can be quite thick and fire resistant, these lateral roots have thinner bark and are easily damaged, even under a low severity ground fire (Ryan *et al.* 1988).

Most research and observations indicate that trees with dead cambium in more than two quadrants (>50% of bole circumference) are poor candidates for survival (Ryan *et al.* 1988). In many cases, cambium injury in more than one quadrant (>25% of the bole) was found to substantially lower tree survival. This is a threshold used in several existing mortality guidelines (Wagener 1961, Ryan *et al.* 1988, Ryan 1990, Weatherby *et al.* 2001, Kootenai NF 1995, Bitterroot NF 2001). As described earlier under crown kill, the interaction of other factors with cambium damage, such as degree of other types of fire damage, susceptibility of the tree to insects or pathogens, tree vigor, etc, exert a substantial influence on the tree's probability of surviving. This is particularly important to remember in the case of Douglas-fir and spruce in the project. Douglas-fir trees with relatively light bole injuries, especially when

associated with crown scorch, are quite attractive to Douglas-fir beetles, especially if beetle populations are abnormally high before the fire, and the same is true for Engelmann spruce (Furniss 1965, Scott *et al.* 1996, Rasmussen *et al.* 1996, Weatherby *et al.* 2001).

### Application to the Robert Wedge Project

The documentation in this report is intended to provide the guidance and criteria to use for assessing individual tree conditions, estimating what trees would be salvaged and which would be left, and evaluating the post-salvage forest condition, as disclosed in the DEIS. The guidelines outlined in Tables 1 and 2 and in the text that follows take into account the situation specific to the project area and the purpose and need for the proposed action.

The main purposes of the proposed salvage actions in the project area is to recover merchantable wood fiber to support local communities and contribute to long term yield of forest products. Important resource objectives that are considered include retaining forest structural elements at desired levels (snags, downed wood, living trees), protecting soil productivity, and providing for the needs of wildlife species that live within, and in some cases benefit from, the fire-changed landscape. Because of the current widespread presence of bark beetle infested Douglas-fir trees in the area, the vulnerability of fire-injured Douglas-fir to bark beetle mortality in these next few years is believed to be high. The fires created conditions suitable for increases in spruce beetle populations as well. That, coupled with suitable habitat both inside and outside the fire perimeter leads to the conclusion that spruce mortality could be high as well. This situation has been taken into account in development of the guidelines in this report.

The estimated mortality risk determinations in the tables below use the variables of species, diameter (DBH), live crown ratio and estimated cambium kill based on bole char, as described earlier in this report. The crown and cambium damage are estimates made by informed and trained people. As described earlier, exploratory sampling through the bark with an axe of the four quadrants of a tree near ground line is a means of estimating cambial damage, with each sample nominally representing 25% of the circumference. This is time consuming and infeasible to apply across the many acres of potential salvage at the site-specific project level; however exploratory sampling is useful for calibrating between visual indicators and actual cambium damage. External appearance of the bole, root crown and soil surface would be used in most situations to assess potential cambial damage, as described under the section on bole/root crown damage.

It must be remembered that the criteria and predictions in the guidelines are based on probabilities and draw upon the available scientific information, as well as professional experience and judgment in the context of the site-specific situation in the project area. It is acknowledged that in following these guidelines, there may be some trees that are removed that would otherwise live, and some trees that are left that will die. The guidelines as developed are generally conservative, erring on the side of leaving trees that might die, rather than taking trees that might live. This recognizes the value that live trees can hold across a burned landscape.

**Table 165. Post-Fire Mortality Risk Considering Remaining Live Crown (Step 1).**

Species	D.B.H.	Remaining live crown ratio ≤ 20%	Remaining live crown ratio 20-40%	Remaining live crown ratio > 40%
Ponderosa pine	< 14"	X	Go to Table 2	Go to Table 2
	≥ 14"	X	Go to Table 2	Go to Table 2

Species	D.B.H.	Remaining live crown ratio ≤ 20%	Remaining live crown ratio 20-40%	Remaining live crown ratio > 40%
Larch	< 14" ≥ 14"	X X	X Go to Table 2	
Douglas-fir	< 14" ≥ 14"	X X	X X	
All other species (lodgepole, white pine, subalpine fir, spruce)	< 14" ≥ 14"	X X	X X	

**Table 166. Post-Fire Mortality Risk Considering Cambium Damage (Step 2).**

Species	D.B.H.	Bole char > 50% of bole/root crown circumference	Bole char 25-50% of bole/root crown circumference	Bole char <25% of bole/root crown circumference and roots exposed/duff consumed	Bole char <25% of bole/root crown circumference and NO roots exposed
Larch, ponderosa pine	All sizes	X			
Douglas-fir	All sizes	X	X		
Lodgepole pine, spruce, white pine subalpine fir	All sizes	X	X	x	

**(NOTE: An "X" in the tables above indicates a tree that is estimated to have a high probability of dying and that may be designated for salvage if within a proposed unit)**

#### **Treatment prescriptions:**

With the Robert-Wedge project purposes and objectives in mind, and knowledge of the site specific and landscape conditions unique to the area, silvicultural prescriptions were developed for proposed salvage units. Prescriptions specify the retention of trees within all salvage units that are currently live and have a good probability of surviving, and removal of most dead and dying trees (other than those needed to provide snag and downed wood habitat). The guidelines outlined in the Tables 1 and 2 above and in the text of this report will be used to help determine these trees.

The salvage harvest is primarily in the areas of moderate to high fire severity, where high tree mortality has occurred. Field reconnaissance has verified that the vast majority of the trees that would be salvaged will be clearly dead (at or near 100% crown scorch or all fine branches/needles consumed by fire), with little question whether they meet the criteria for removal or not defined in the tables above. Nearly all trees have multiple fire injuries, with

crown scorch associated with bole char and damage to root systems in the shallow rooted species. Mortality of trees may occur directly because of the fire injuries, or due to other related factors, such as bark beetle infestation in Douglas-fir or spruce. As much of the literature confirms, this form of post-fire mortality often has a substantial impact on Douglas-fir and spruce (Furniss 1965, Ryan 1982, Amman & Ryan 1991, Ryan & Amman 1996, Rasmussen *et al.* 1996, Scott *et al.* 1996, FHP 2000, Weatherby 2001).

Presence of successful bark beetle attacks (beetle boring dust, pitch tubes, galleries, etc) indicates a tree that should be salvaged, whether or not it has evidence of fire damage. This is particularly relevant in the case of Douglas-fir and spruce bark beetle. Not only are these trees imminently dead (i.e. especially if attacks are found over at least half of the bole circumference), they also will contribute to higher beetle populations in the project area, with resulting mortality to remaining live trees.

A tree with a green crown but with root/bole char may retain its green crown for a year or more after the fire, even though the tree is “dead” due to the cambium damage. This results from stored food reserves within the tree, in some cases its ability to still transport some water from the roots, or delayed reaction to severe stress.

Larch is the most fire tolerant species in this area. They have thick, fire resistant bark and are deeper rooted, thus it takes a greater amount of heat to cause damage to the boles, root crowns and root systems. Field observations and exploratory sampling to determine cambium damage suggest that most of the time, if there is adequate live green crown in the trees, the fire was not severe enough to damage the cambium, even if the bole is charred. Criteria for retention of larch and (ponderosa pine) trees in Tables 1 and 2 are particularly conservative, considering their fire tolerance, their value as snags (and live trees) across this landscape, and their lack of vulnerability to the bark beetles of concern.

Shallow rooted species are particularly susceptible to damage of small feeder roots close to soil surface, and include subalpine fir and spruce. White pine is moderately susceptible. Douglas-fir with large lateral roots at or above the soil surface is very susceptible to root injury. These factors will be taken into account when utilizing Table 2 above.

An evaluation of the duration and intensity of the fire that occurred at and near the base of the tree will help in estimating degree of root injury (refer to visual indicators described under Bole/Root crown section earlier). Many sites proposed for salvage had not experienced a fire for 200+ years prior to the fire. This allowed substantial accumulations of duff and woody debris on these sites. Field reconnaissance suggests that in areas burned at moderate severity, the duration of fire and heat that resulted in the significant reduction of the duff and surface fuel accumulations has probably been enough to cause at least some degree of root damage to Douglas-fir and other shallow rooted species. Trees in these areas usually show significant charring of their lower bole/root collars at a minimum, and usually far greater bole charring and crown scorch. Even in some of the areas burned at low severity, an “underburn” with relatively little crown scorch, trees have often experienced significant charring and injury to the lower bole and probably the root systems of shallow rooted species as well.

Live crown ratio would be a major variable focused on (Table 1 above) at the implementation phase (the timber sale contract development and implementation). It is the most prominent and common indicator. It is easier to detect and interpret. It is usually associated with trees that have extensive bole char as well and tends to correlate with cambium injury, though not under all fire conditions (Furniss 1965). It is a common (if not the most common) indicator used in the literature and in practice to predict mortality and develop mortality guidelines. Many studies also identify crown damage as a primary injury contributing to tree death (Wagener 1961, Peterson 1985, Ryan *et al.* 1988, Stephens and Finney 2001) particularly on

the thicker barked trees. In evaluation of this criteria, the live crown portion of the tree should show a relatively low degree of fire damage to be considered “live”, and have a fairly good complement of green, live foliage.

Bole/root crown char, as an indicator of cambium injury, would also be used as a variable in leave tree/salvage tree selection at the implementation phase. It is particularly applicable for use in the thin barked species (lodgepole pine, subalpine fir and spruce). These species are very sensitive to bole heating and even light char usually indicates underlying dead cambium. Degree of bole char indirectly reflects the intensity of the fire and thus can also help to assess the degree of root injury that may have occurred in more shallow rooted species, as described above.

Because its needles are shed in the fall, in units that might be winter logged all larch that meet the retention tree guidelines would be marked with paint, to ensure they would be not mistaken for a dead tree.

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Heidi Trechsel

Silviculturist

Flathead National Forest

September 2002

Revised for West Side Reservoir Fires:

Betty Kuropat

May 2004

Revised for Robert-Wedge Fires:

Larry Kent, Silviculturist

June, 2004

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APPENDIX C: Robert – Wedge Canyon Post-Fire EIS Interdisciplinary Team's Response to the 1995 Beschta Report<sup>4</sup>

Beschta *et al.*, 1995 contains general principles and recommendations for post-fire salvage and other treatments on Federal land in the interior Columbia and Upper Missouri Basins. The interdisciplinary (ID) team reviewed the report and considered pertinent information in the design of the proposed action and alternatives, and analysis of potential environmental consequences. The following documents the team's consideration of the report's recommendations. In addition, various portions of Chapter 3 of the EIS also address and respond to these same recommendations.

### **“Findings and Recommendations For Fire Management and Salvage Logging”**

#### **1. “Ongoing human activity and the residual effect of past activity continue to threaten watershed ecosystem integrity.”**

- “The ability of ecosystems to recover has been substantially compromised due to past management activity.”
- “Attempting to continue to manage fire and its consequences without altering or controlling other threats to ecosystems integrity, including logging, grazing, road building, and mining is scientifically and pragmatically unsound.”

#### **ID Team Response:**

The ID team does not dispute this point of Beschta *et al.*, but we believe that human intervention can help to undo the undesirable effects of past management and hasten the restoration of the watershed. The ID team recognizes that there are degraded conditions within the watershed that are the result of past management activities. A description of these conditions can be found in the Affected Environment descriptions in the Vegetation, Soils, Hydrology, Wildlife, and Fisheries sections of Chapter 3 of the DEIS.

The historic timber harvest and road construction activities responsible for the degraded conditions in the watershed were conducted before the development of modern land management philosophy, which emphasizes watershed and ecosystem protection. This philosophy is embodied in Forest Plan Standards and Guidelines that require the use of Best Management Practices and adherence to specific protections for soils, water quality, fish habitat, and wildlife. The action alternatives proposed would have long-term benefits to watershed integrity. The closure of at least 56 miles of road, upsizing culverts to accommodate higher peak flows, and other road maintenance performed in conjunction with Best Management Practices would all lead to reduced sediment and water yield from the road system in the future. Speeding up vegetative recovery in the fire through planting would improve the soil holding capacity of a site. Low-impact harvest techniques would minimize soil disturbance and retain a biological legacy of organic material on all units.

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<sup>4</sup> Beschta, R.L.; Frissell, C.A.; Gresswell, R. [and others]. 1995. Wildfire and salvage logging: recommendations for ecologically sound post-fire salvage logging and other post-fire treatments on Federal lands in the West. Corvallis, OR: Oregon State University.

**2. “Fires are an inherent part of the disturbance and recovery patterns to which native species have adapted.”**

- “Fires are a part of the pattern of disturbance and recovery that provides a physical template for biological organization at all levels.”
- “The ‘patchiness’ of fire is a desirable characteristic, and many species depend on the environmental influences that fires create.”

**ID Team Response:**

The DEIS recognizes in several places that fire is an inherent part of disturbance and recovery patterns in the project area. For instance:

“Consequently, harvest of dead trees will leave stands with irregular forest structure. Gaps or patches of openings will be interspersed with live green trees from sapling, pole, and mature size classes. The residual structure will be represented by a mixture of live green trees of all sizes, small diameter dead trees, and large diameter snags.”

“Disturbances such as insects, disease, and fire, are all a natural part of the ecosystem, with the wildlife, vegetation, and other components of the ecosystem evolving and responding to the influence of these processes for many thousands of years.”

“The majority of the Project Area had not experienced a large-scale or stand replacing fire for over 200 years. Mature forest conditions dominated the watershed. The long fire interval and resulting extensive area of mature forest type created a landscape of relatively high vulnerability to effects from disturbances such as fire or bark beetles. The vast blowdown and resulting large-scale spruce beetle epidemic in the 1950s and 60s illustrate this, as does the Robert and Wedge Canyon Fire events to some degree. These both were natural events, not unprecedented and not unpredictable, considering the fire regimes within the area, the long fire-free interval, and the forest conditions across the landscape.”

“Wildland fire was a dominant disturbance in the North Fork watershed prior to the 1930s.”

“While the fish populations in the watershed certainly experienced large fires and epidemics of bark beetle related mortality in the past, it is unclear whether the depressed contemporary populations are capable of coping with the extremes of these disturbance types.”

The ID team recognizes that wildfire is a natural component of our environment that is beneficial, and even essential, for many native species of plants and animals. The vast majority of the burned area would receive no treatment, but would be allowed to respond to the fire as natural processes determine it should. The action alternatives were crafted to retain the ecological benefits of the fire while responding to the needs of society and goals of the Flathead Forest Plan.

**3. “There is no ecological need for immediate intervention on the post-fire landscape.”**

- “With respect to the need for management treatments after fires, there is generally no need for urgency, nor is there a universal ecologically-based need to act at all.”

**ID Team Response:**

The Post-Fire Project is intended to respond to an array of needs: social, economic, and regulatory, as well as ecological. We also felt there was an economic need to salvage trees, especially on lands within the fire where timber production is the primary goal, as designated

by our Forest Plan. Many members of the local community support salvaging burned trees, and said so during the initial public scoping for the project (project record). Burned trees deteriorate rapidly and lose their economic value if not harvested in a timely manner.

The ID team does believe there are ecological benefits that can be realized through rapid intervention in the burned area. The Burned Area Emergency Recovery (BAER) team replaced several culverts with larger ones to better accommodate the increased runoff that is likely to occur because of the fire, possibly preventing many tons of sediment from reaching streams. Other numerous activities were undertaken reduce soil movement and reduce the potential for noxious weed spread. Speeding up vegetative recovery in the fire through planting of native species would improve the soil holding capacity of a site and benefit wildlife by inhibiting the establishment of unpalatable invasive plants.

Beschta *et al.* calls for a conservative approach. We feel we have taken a very conservative approach by proposing activities on approximately a third of the acres that the 2 fires burned.

**4. “Existing condition should not be used as “baseline” or “desired” conditions upon which to base management objectives.”**

**ID Team Response:**

Our desired conditions and management objectives are based on our Forest Plan. The existing condition is compared to the desired condition, and this determines what actions might be appropriate to move closer to desired conditions. Desired conditions state what environmental, social, or commodity values are desirable for a particular land base.

Recovery goals and habitat indices for listed species such as the grizzly bear and the bull trout are based upon the best available science, and incorporate data from population viability models. Habitat quality measures such as home range sizes and streambed fine sediment concentrations have been developed by reviewing appropriate scientific literature and, where possible, gathering reference data in undisturbed wilderness areas.

**5. “Fire suppression throughout forest ecosystems should not automatically be a management goal of the highest priority.”**

**ID Team Response:**

Fire suppression is used to meet land management objectives related to protection of life, property and resources. General fire suppression recommendations are outside the scope of this salvage proposal and analysis. The Flathead Forest Plan presently requires that all wildland fires be suppressed unless they occur in a wilderness area covered by an approved Fire Management Plan. At the same time the Robert and Wedge Canyon Fires were burning, several large fires were allowed to burn on Flathead National Forest lands in wilderness areas.

**6. “The region's ecosystems, not just forests, are under severe strain.”**

- “Virtually all western landscapes have been subjected to severe disruption by human activities.”
- “From a watershed perspective.... the primary cure rests in curtailing human activities known to be damaging and counterproductive, and repairing or restoring roads that act as a permanent sources of adverse impact.”

### **ID Team Response:**

The ID team agrees that many of the region's ecosystems have been impacted by human activities. The western United States has witnessed rapid population growth in recent decades, and the Flathead Valley is no exception, being one of the fastest growing counties in Montana. Along with this increase in population has come increased demand for forest resources, including timber, recreation, food, and fuel. Despite this, timber production from Flathead National Forest land has been reduced substantially in recent years, and access for recreation and other purposes has been made more difficult by road closures intended to provide greater security for wildlife. Public land management requires a balance between ecosystem protection and suitable resource utilization to meet the needs of society. The direction for achieving that balance on the Flathead National Forest is contained in the Forest Plan, which was developed to comply with numerous federal laws, and has guided the ID team during the development of this project.

Beschta et al. calls for repairing or restoring roads to ease the strain on ecosystems. A another foreseeable project on a similar timeline as this project (refer Chapter 1) is proposing to repair and maintain roads within the Robert and Wedge Canyon Fires by the application of Best Management Practices. This project is currently going through the planning process in a separate project; however, the cumulative effects of these actions have been considered in this DEIS.

### **“Post-Fire Principles”**

“We recommend that management of post-fire landscapes should be consistent with the following principles:”

#### **7. “Allow natural recovery and recognize the temporal scales involved with ecosystem evolution. “**

- “Human intervention on the post-fire landscape may substantially or completely delay recovery.... or accentuate the damage.”
- “There is little reason to believe that post-fire salvage logging has any positive ecological benefits, particularly for aquatic ecosystems.”
- “There is considerable evidence that persistent, significant environmental impacts are likely to result from salvage projects...These impacts include soil compaction and erosion, loss of habitat for cavity nesting species, loss of structurally and functionally important large woody debris.”

### **ID Team Response:**

Analysis of the potential effects of the Post-Fire Project by the ID team did not indicate a risk that ecosystem processes would suffer any measurable delay as a result of the proposed activities. Soils, seed banks, and live vegetation would be protected in harvest units through the use of low-impact harvest techniques and adherence to Best Management Practices. The specific protective measures are discussed in Appendix D and the vegetation and soils sections of Chapter 3 of the DEIS.

The Burned Area Emergency Rehabilitation effort seeded a total of 1120 acres within both fires where soil erosion was a concern, and the species used were either native or annual species that will not impact long-term succession.

Our intervention would promote species diversity and reforestation in areas lacking in seed source either due to previous harvest or high fire intensities. In stands where serotinous

lodgepole pine seed is abundant, planting promotes species diversity in what would otherwise become a monoculture. National Forest System lands are managed under multiple use and sustained yield mandates where social benefits are considered. Human intervention on the Robert and Wedge Canyon Fires would allow for the recovery of salvageable wood products for society, and reduce the impact of bark beetles on remaining green stands. These are both items forest managers and many sectors of the public have deemed desirable (See Forest Plan, and project record).

**8. “No management activity should be undertaken which does not protect soil integrity.”**

- “Soil loss and compaction are associated with both substantial loss of site productivity and with off-site degradation (water quality).”
- “Reduction of soil loss is associated with maintaining the litter layer.”
- “Although post-burn soil conditions may vary depending upon fire severity, steepness of slope, inherent erodibility, etc., soils are particularly vulnerable in burned landscapes.”
- “Post-burn activities that accelerate erosion or create soil compaction must be prohibited.”

**ID Team Response:**

Design criteria in our project ensure soil integrity in all action alternatives; they minimize displacement, compaction or erosion of soil (see Chapter 2 of DEIS). Also refer to the Affected Environment and Environmental Consequences in the Soils section (Chapter 3 of the DEIS).

**9. “Preserve species’ capability to naturally regenerate.”**

- “If warranted, artificial regeneration should use only species and seed sources native to the site, and should be done in such a way that recovery of native plants or animals is unhampered.”

**ID Team Response:**

Nothing we are proposing affects the capability of species to regenerate (see vegetation section in Chapter 3 of the EIS). There are areas lacking a conifer seed source due to past management or because of high fire severity. Hand planting native conifers would promote the re-establishment of forest stands containing a natural diversity of tree species. The Post-Fire Project recognizes the value of promoting the reestablishment of native plant species.

Page 3-25: “Seedlings planted on national forest system lands almost always (the exception is rust- resistant white pine) come from seed sources native to the site, and are native species found on the habitat types being planted (Beschta et al. 1994). This would be the case on the Robert-Wedge project as well.”

**10. “Do not impede the natural recovery of disturbed systems.”**

**ID Team Response:**

Our project is designed to enhance natural recovery and would not impede it. As described above, there are areas lacking a seed wall, which is necessary to the natural recovery of conifer trees. Where a seed source is lacking because of the fire or past management actions,

exotic weed species may delay recovery of the native vegetation. The Flathead Forest will combat the spread of exotic and invasive weed species, which are often opportunistic colonizers of disturbed sites such as fire areas. Non-native plant species such as spotted knapweed are capable of excluding native plant species and significantly impeding the recovery of the ecosystem.

## **“Recommendations On Post-Fire Practices”**

### **11. “Salvage logging should be prohibited in sensitive areas.”**

- “Logging on sensitive areas is often associated with accelerated erosion and soil compaction.”
- “Salvage logging by any method must be prohibited on sensitive sites, including: severely burned areas (no duff layer), on erosive soils, on fragile soils, in roadless areas, in riparian areas, on steep slopes, or any site where accelerated erosion is possible.”

#### **ID Team Response:**

The team considered sensitive areas when designing the proposed action. Best Management Practices (BMPs) and the Flathead Forest Plan mandate specific protections for soils and water bodies during silviculture operations. All the action alternatives meet or exceed these standards. The primary objective of our design criteria is to minimize soil disturbance, by either using helicopter yarding, winter logging sensitive sites, no ground-based logging on high burn severity areas, or the required use of slash mats.

Beschta et al. includes roadless areas in the list of sensitive areas. No activities are proposed in roadless areas.

The ID team shares the authors’ concern for the protection of sensitive areas. Our concern is reflected in the requirement that all management activities utilize Best Management Practices, which are described in Appendix D of the DEIS, and include direction such as:

Winter logging will be done when the ground has enough snow or is frozen enough so operations do not cause wet muddy soil to bleed into the snow or appear in tracks.

Tops and branches will be left in the units to provide ground cover that reduces soil erosion rates and if needles remain provides nutrients. Whole tree yarding is not acceptable.

Avoid tractor skidding on unstable, wet, or easily compacted soils and on slopes that exceed 40% unless operation can be conducted without causing excessive erosion.

Design and locate skid trails and skidding operations to minimize soil disturbance.

### **12. “On portions of the post-fire landscape determined to be suitable for salvage logging, limitations aimed at maintaining species and natural recovery processes should apply.”**

“Dead trees (particularly large dead trees) have multiple ecological roles in the recovering landscape including providing habitat for a variety of species, and functioning as an important element in biological and physical processes. In view of these roles, salvage logging must leave at least 50% of the standing dead trees in each diameter class; leave all trees greater than 20 inches dbh or older than 150 years; generally, leave all live trees.”

“Because of soil compaction and erosion concerns, conventional types of ground-based yarding systems should be generally prohibited.”

“Helicopter and cable systems using existing roads and landings may be appropriate, however, even these.... methods could locally increase runoff and sediment.”

**ID Team Response:**

The areas we are proposing to salvage log were chosen specifically to meet the purpose and need for removing the most susceptible trees, some of which are greater than 20 inches dbh. We fully recognize the value of dead trees in biological and physical processes (Refer to the Deadwood Habitat Prescription Matrix in Appendix F of the DEIS) which exceeds Forest Plan standards for retention, recruitment, and cycling of snags and coarse woody material at levels that maintain ecological processes across the landscape.

Potential runoff and sediment from this project are discussed in the soils and hydrology sections of Chapter 3 of the DEIS, and above in this document. All harvest and road related activities proposed in this project would be consistent with our goal of minimizing soil erosion and negative impacts to both terrestrial and aquatic environments.

**13. “Building new roads in the burned landscape should be prohibited.”**

- “Roads are associated with a variety of negative effects on aquatic resources, including the disruption of basin hydrology and increased chronic and acute sedimentation.”
- “Under no circumstances should new roads be introduced into sensitive areas, including roadless or riparian areas.”
- “Outside of these areas, road building should be avoided except where new road construction may be necessary to complete a larger program of partial or complete road obliteration. In some instances, offsetting benefits must be demonstrated. This may include cases in which a new road segment has been demonstrated to be necessary to enable the obliteration of other roads that cause significant potential or existing adverse environmental impacts.”

**ID Team Response:**

The ID team agrees with the assessment of Beschta et al. that roads can have a substantial negative impact upon aquatic resources. The proposed action does not consider the building of any system roads. Temporary roads would be stabilized and decommissioned. Proposed decommissioning of road to address A19 would provide future benefits to the aquatic ecosystem by reducing both water yield and sediment yield. The Flathead National Forest is also conducting, in a separate project, the upgrade of several miles of road in the fire areas to BMP standards. The combined implementation of this BMP project and the action alternative of the Post-Fire Project would be a significant improvement in the health of the aquatic environment in the watershed.

**14. “Active reseedling and replanting should be conducted only under limited conditions.”**

- “Active planting and seeding has not been shown to advance regeneration and most often creates exotic flora. Therefore, such practices should be employed only where there are several years of evidence that natural regeneration is not occurring.”

- “Native species from regional stocks that may enhance fire resistance of a site maybe planted if the effect is to not homogenize the landscape.”
- “Seeding grasses into burned forests has been shown to disrupt recovery of native plants and is likely to create more problems than it solves.”
- “The use of pesticides, herbicides, and fertilizers should generally be prohibited.”

**ID Team Response:**

No exotic flora is proposed for planting or seeding. Natural regeneration is expected to create a homogenous sea of lodgepole pine in many areas across the fire, as experienced on the Red Bench Fire of 1988. The fires of 1910, 1919, and 1926 created many acres of lodgepole pine monoculture across the Flathead National Forest, which precipitated the mountain pine beetle outbreaks of the 1970s and 1980s. Planting of conifer seedlings in salvage units would enhance species diversity. Seeds are collected from local trees and grown at the regional nursery. Seedlings are out-planted according to suitable elevation and habitat type. This is standard operating procedure. Areas harvested prior to the Robert and Wedge Canyon Fires require reforestation in accordance with the National Forest Management Act, and would be replanted (See vegetation section of Chapter 3 of the DEIS).

The prohibition on use of herbicides recommended by Beschta et al. ignores the very real problem of exotic, invasive species that can have a negative impact upon native plant and animal communities. In several of the discussion points above, the authors of Beschta et al. encourage land managers to allow the natural recovery of native species. This process may be greatly retarded or prevented altogether if exotic weed species are not controlled. Chapter 3 of the DEIS identifies 20 exotic, noxious weed species known to exist in the vicinity of the Fire Areas. The Flathead national Forest will use hand application of approved herbicides applied in accordance with our Noxious and Invasive Weed Control Environmental Assessment (USDA Forest Service 2000b) to control exotic plant species and promote the recovery of a native vegetation community. Large scale aerial spraying would not occur.

**15. “Structural post-fire restoration is generally to be discouraged.”**

- “Hard structures (in-stream and on land) are not generally modeled or sited based on natural processes, and their ability to function predictably may be particularly low in dynamic post-fire landscapes.”
- “Sediment management should focus on reducing or eliminating anthropogenic sources prior to their initiation (i.e., stream crossings), and protecting/maintaining natural sediment control mechanisms in burned landscapes, particularly the recruitment of large woody debris on hill-slopes and in streams.”

**ID Team Response:**

A pulse of large woody debris is expected to enter streams in the fire area in coming years. Most tributaries will be allowed to respond to this influx of wood naturally, with no direct management intervention. Naturally occurring migration barriers may be opened if they form, under supervision of the hydrologist and fisheries biologist, to protect bull trout spawning. The formation of migration barriers is considered unlikely.

No hard structures are proposed with the Post-Fire Project. Best Management Practices are designed to remove anthropogenic sediment sources and all action alternatives optimize recruitment of large woody debris by streams. Hill slopes would have adequate woody debris left in accordance with Amendment 21. The maintenance of riparian buffer strips as required

by INFISH would insure an adequate supply of large woody debris would be available to control sediment in streams and adjacent riparian areas.

**16. “ Post-fire management requires reassessment of existing management.”**

- “By increasing runoff, erosion, and sedimentation, fires may increase the risks posed by existing roads.”
- “Therefore, post-fire analysis is recommended to determine the need for undertaking road maintenance, improvement, or obliteration.”
- “There is some urgency to this reassessment as the longer appropriate treatments are put off, the more likely it is that failure will be triggered by a large runoff event.”

**ID Team Response:**

We agree with Beschta et al. that there is an urgent need to address potential problems arising from fire effects, particularly those that may overwhelm existing road structures. The BAER process considered existing management and the risks inherent in the condition of the watershed. Due to this assessment, numerous fire recovery and rehabilitation projects have been accomplished, are ongoing, or are planned, and the management activities in this project were proposed. The transportation system was assessed and roads would be decommissioned to improve water quality and move towards standards for motorized access requirements described in Amendment 19 to the Forest Plan.

**17. “Continued research efforts are needed to help address ecological and operational issues.”**

- “There is a need to research certain questions in order to guide post-fire management decisions. For example, some argue that salvage logging is needed because of the perceived increased likelihood that an area may reburn.”
- “Research is needed on the role of dead wood in terrestrial ecosystems – in particular, how much wood should be left on a particular site and across the landscape to provide for the full range of ecosystem processes and the needs of species.”
- “...new research efforts are needed to evaluate the environmental effects of alternative post-fire/salvage operations, roading activities, and site preparation.”

**ID Team Response:**

The effects analysis in the fuels section in Chapter 3 discusses the reburn issue. The team recognizes that the likelihood of an ignition does not change because an area is salvaged. What may change are fire behavior and fire effects should an ignition occur. According to Louisa Evers, fire ecologist and fire behavior analyst, considerable research has begun regarding fire ecology, fire effects, fire risks, fire recovery, and restoration as part of the Joint Fire Science Program and the National Fire Plan. There is already a considerable body of research regarding the environmental effects of salvage, road construction and management, and site preparation effects and the role of downed wood in terrestrial ecosystems.

Beschta *et al.* (1995) state “We are aware of no evidence supporting the contention that leaving large dead woody material significantly increases the probability of a reburn.” We agree with the authors of the Beschta Report that the amount of fuel does not affect the probability of reburn or wildland fire ignitions in general. The meteorological and physical processes that generate lightning, and the human behavior that leads to human-caused fires

determine the probability of ignition. The purpose and need of the fuel reduction portions of the Moose Post Fire Project is not to reduce the probability of ignition or the occurrence of future fires. Rather, it is to reduce the intensity and severity of future fires, when they inevitably occur, by reducing the amount of dead vegetation that would fall to the ground and accumulate over time. There is abundant scientific evidence that increased fuel loads can result in increased fire intensity and severity. In other words, given the same weather and topographic conditions, areas with higher fuel loads would release more energy (burn hotter), exhibit longer flame lengths, have greater potential to convert to crown fires, be more difficult to contain, pose greater risks to firefighters, kill more vegetation, and damage soils more severely than areas with lower fuel loads. In addition, there is clear scientific evidence and abundant experience demonstrating large continuous areas of relatively high fuel loads are more likely to result in larger fires than areas where the spatial arrangement of high fuel loads is discontinuous.

As stated in the Beschta document, the degree of alteration of fire regimes varies across the landscape. Moist forest types (low frequency-high intensity fire regime), such those found in North Fork, have been less altered through fire suppression activities than dry pine forests (high frequency-low severity fire regime) (Agee 1994).

**18. “The public must be educated regarding natural fires and post-burn landscapes to provide balance to the ‘Smokey Bear’ perspective of fires and forests.”**

- “Although post-fire landscapes are often portrayed as “disasters” in human terms, from an ecological perspective, fire is part of the normal disturbance regime and renewal of natural forest ecosystems.”
- “Increased appreciation and understanding of natural disturbance regimes in the ecology of forest ecosystems is needed by the public, and the public’s land managers.”

**ID Team Response:**

We agree with the authors that the historic portrayal of fire as an entirely harmful event failed to recognize the important role of fire in maintaining the forest ecosystem. Fire history, disturbance regimes, and the ecology of forest ecosystems are topics discussed in this DEIS.

Again, from Louisa Evers, “Experience has shown that even when popular support for wildland fire use is high, this support is largely intellectual. A more emotional response is more typical once a fire happens where these same people can see it every day. The tolerance for the fire drops rapidly, especially for long duration fires that produce direct impacts from smoke and when fires threaten to move into wildland-urban interface areas.” This was certainly the case with the Robert and Wedge Canyon Fires in 2003.

Regional or nation-wide efforts to provide information on natural fires and post-burn landscapes are outside the scope of the DEIS. Locally, the Flathead National Forest is hosting tours of the burned area for the general public, during which Forest Service employees provide information regarding the role of fire in the environment.

## **“Recommendations Concerning Fire Management”**

### **19. “Fire suppression activities should be conducted only when absolutely necessary and with utmost care for the long-term integrity of the ecosystem and the protection of natural recovery processes.”**

- “Pumping from small streams and rivers increases the risk to aquatic ecosystems from post-fire events. When pumping is utilized, it should be conducted from sufficiently large streams and lakes that the effects on aquatic biota are negligible.”
- “Fire suppression should not include bulldozing stream channels, riparian areas, wetlands, or sensitive soils on steep slopes or using such areas as access routes for vehicles and other ground-based equipment.”
- “Virtually no fire suppression should be permitted in wilderness areas.”

#### **ID Team Response:**

This recommendation is beyond the scope of the DEIS; however, for the record, minimum impact suppression techniques were used on the Robert and Wedge Canyon Fires whenever possible. As noted above, simultaneous with these fires, there were several fires burning in wilderness portions of the Flathead National Forest. No fire suppression actions were employed on these fires. Historic wilderness cabins were protected with sprinklers and reflective wrap. The specific environmental effects of fire suppression activities on the Fires are discussed at length in the Cumulative Effects Analysis portions of Chapter 3 in the DEIS.

### **20. “When land ownerships are mixed, the federal land management agencies should establish policies to prevent conflicts between re-establishment of natural disturbance regimes on federal land and the protection of private property.”**

#### **ID Team Response:**

This recommendation is beyond the scope of the Post-Fire Project. However, the ID team agrees with this point of Beschta et al. The Flathead National Forest allows naturally ignited fires to burn in wilderness areas if there is a valid Fire Management Plan, and the forest also maintains an active program of prescribed burning.

#### *Additional considerations by the team:*

The team also used the review of related literature by the Kelsey Beaver interdisciplinary team (Kootenai National Forest, 2001) in considering the Beschta et al. position paper, as well as reading the original literature by George Ice, Susan Conard, Richard Everett, Susan Husari, Alan E. Harvey, Gordon H. Reeves, James Saveland, C. Phillip Weatherspoon, Robert Zeimer, Ice and Beschta, and Louisa Evers. The team is also aware of the Chiefs Testimony to Congress and the rebuttal by the authors of the Beschta Report. We did not feel the rebuttal unveiled any new considerations.

APPENDIX D: BEST MANAGEMENT PRACTICES (BMPs)

## **INTRODUCTION:**

Best Management Practices (BMPs) are the primary mechanism to enable the achievement of water quality standards (Environmental Protection Agency 1987). This Appendix describes the Forest Service's BMP process. It lists the key Soil and Water Conservation Practices (SWCP) as outlined in Forest Service Handbook 2509.22 that are to be used during the planning and/or implementation of the proposed action described for the Robert-Wedge Post-Fire Project. Also described are each SWCP that would be refined for site-specific conditions to protect beneficial uses and meet water quality objectives.

BMPs include, but are not limited to, structural and nonstructural controls, operations, and maintenance procedures. BMPs can be applied before, during, and after pollution producing activities to reduce or eliminate the introduction of pollutants into receiving waters. Usually BMPs are applied as a system rather than a single practice. BMPs are selected based on site-specific conditions that reflect natural background conditions and political, social, economic, and technical feasibility.

## **STATE REQUIREMENTS FOR PROTECTION OF WATER QUALITY:**

Compliance with State requirements for protection of waters of the State of Montana (Administrative Rules of Montana, 16.20.603) means that "land management activities must not generate pollutants in excess of those that are naturally occurring regardless of the stream's classification. 'Naturally occurring' is defined in the Administrative Rules as that water quality condition resulting from runoff or percolation over which man has no control or from developed land where all 'reasonable' land, soil, and water conservation practices' have been applied." The Administrative Rules also state "Best Management Practices are 'reasonable' only if beneficial uses are protected" (i.e. fisheries). Land management activities that comply with Montana water quality law and regulations have three elements in common:

1. BMPs are applied;
2. Beneficial uses are not impaired; and
3. Monitoring is in place to test whether BMPs are adequate to protect beneficial uses.

Montana State Water Quality Standards require the use of Reasonable Land, Soil, and Water Conservation Practices (analogous to BMPs) as the controlling mechanism for non-point pollution. Use of BMPs is also required in the April, 1987 Memorandum of Understanding (MOU) between the Forest Service and the State of Montana as part of our responsibility as the Designated Water Quality Management Agency on National Forest System lands.

## **BMP IMPLEMENTATION PROCESS:**

In cooperation with the State, the Forest's primary strategy for the control of non-point sources is based on the implementation of preventive practices (BMPs) determined necessary for the protection of the identified beneficial uses.

The Forest's Non-point Source Management System consists of:

1. BMP selection and design based on site-specific conditions; technical, economic and institutional feasibility; and the designated beneficial uses of the streams.
2. BMP application.

3. BMP monitoring to ensure that they are being implemented and are effective in protecting designated beneficial uses.
4. Evaluation of BMP monitoring results from 'step' 3.
5. Feeding back the results into current/future activities and BMP design. The District Ranger is responsible for ensuring that this BMP feedback loop is implemented on all projects.

### **FORMAT OF THE BMPS:**

The Practices (BMPs) described herein are tiered to the practices in Forest Service Handbook 2509.22 (Soil and Water Conservation Practices Handbook.) They were developed as part of the NEPA process, with interdisciplinary involvement and meet Forest and State water quality objectives.

Each Soil and Water Conservation Practice (SWCP) listed below is described as follows:

- **TITLE:** Includes the sequential number of the Practice and a brief title.
- **MONTANA BMPS:** Includes references for compliance to the State BMPs.
- **POST-FIRE PROJECT SPECIFIC BMPS:** A listing of any project specific BMP to be used during the implementation of the Moose Post-Fire Project.
- **OBJECTIVE:** Describes the SWCP objective(s) and the desired results for protecting water quality.
- **EFFECTIVENESS:** Provides a qualitative assessment of expected effectiveness that the applied measure would have on preventing or reducing impacts on water quality. The SWCP effectiveness rating is based on literature and research, administrative studies, and professional experience. The SWCP is rated High, Moderate, or Low based on the following criteria:
  - a. Literature/Research (must be applicable to area)
  - b. Administrative studies (local or within similar ecosystem)
  - c. Experience (judgment of an expert by education and/or experience)
  - d. Fact (obvious by reasoned, logical response or observation)
- **IMPLEMENTATION:** This section identifies how the BMP practices are expected to be applied during project implementation.

Following the section on SWCPs, all the appropriate BMPs for the Post-Fire Project are listed as extracts from the Best Management Practices for Forestry in Montana (Dec. 1997).

### **ITEMS COMMON TO ALL SOIL AND WATER CONSERVATION PRACTICES:**

**Responsibility for Implementation:** The Hungry Horse/Glacier View District Ranger is responsible for ensuring that all applicable SWCPs are applied and implemented. The Operation Team Leader is responsible for ensuring that the objectives of the SWCPs identified in this appendix are incorporated into the Timber Sale Contract by use of the appropriate Timber Sale Contract CT provisions. The Timber Sale Administrator is responsible for ensuring that contract provisions are properly administered on the ground.

**Monitoring:** The Timber Sale Administrator, Forest Soil Scientist, and Forest Hydrologist as needed, would monitor the effectiveness of the applied SWCPs. Should the practice not be

effective in meeting State or Forest Plan standards, the practice or project activity would be redesigned, rescheduled, or dropped.

### **SWCPs For The Robert and Wedge Canyon Post-Fire Project:**

The applicable SWCPs are listed by practice number along with the objective of the practice described. The related Montana State BMPs are listed and any Post-Fire Project specific BMPs are also listed. The references for the Montana State BMPs are not listed in this document.

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#### **PRACTICE 11.07 - Oil and Hazardous Substance Spill Contingency PRACTICE 15.11 - Servicing and Refueling of Equipment**

##### **MONTANA BMPs: VII A 1-2.**

**OBJECTIVE:** To minimize contamination of waters from accidental spills of fuels, lubricants, bitumen, raw sewage, wash water, and other harmful materials by prior planning and development of Spill Prevention Control and Countermeasure Plans.

**EFFECTIVENESS:** High [obvious by reasoned, logical response or observation]

b The Contracting Officer, Engineering Representative, or certified Sale Administrator would designate the location, size, and allowable uses of service and refueling areas. They would also be aware of actions to be taken in case of a hazardous spill, as outlined in the Forest Hazardous Substance Spill Contingency Plan (SWCP 11.07). Contract provisions CT6.34 Sanitation and Servicing and BT6.341 Prevention of Oil Spills are included in all timber sale contracts. BT6.341 requires the purchaser to prepare a spill prevention control and countermeasure plan, which shall meet applicable EPA requirements, including certification by a registered professional engineer. This requirement is enacted when the total oil or oil products storage exceeds 1,320 gallons, or if any single container exceeds a capacity of 660 gallons.

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#### **PRACTICE 14.02 – Timber Harvest Unit Design PRACTICE 13.06 - Soil Moisture Limitations for Tractor Operation PRACTICE 13.02 - Slope Limitations for Tractor Operation**

##### **MONTANA BMPs: IV A 1, 2, 4, 5, 6. IV B 1, 6; IV C 2, 5.**

**OBJECTIVE:** To insure that timber harvest unit design would secure favorable conditions of water flow, maintain water quality and soil productivity, and reduce soil erosion and sedimentation, during and following salvage logging.

These recommendations are based on burn severity ratings, (the fire's effect on soil) and on slope, which relates to erosion hazard. In addition, special management practices are outlined for units where the fine branches and needles were completely burned.

##### **Low/unburned or Low Burn Severity Rating:**

In general, our standard contract provisions would adequately protect soils with low or unburned severity rating classes.

On slopes < 35 percent:

- Winter log
- Summer log using dedicated skid trails spaced 75 feet apart when soils are moist as determined by the field method
- If equipment can not operate at 75 foot spacing then the trails can be closer if the equipment operates on a slash mat consisting of fine material less than 3 inches in diameter and needles.
- Summer log using dispersed skidding when soils are dry or moist as determined by the field method. Be aware that the soils are unlikely to dry if the vegetation is mostly dead.

On slopes > 35 percent:

- Cable log in summer or winter
- Helicopter log

Pre-bunching logs with a feller-buncher is acceptable if the soils are snow covered

**Moderate Burn Severity Rating:**

On slopes < 35 percent:

- Winter log
- Summer log using dedicated skid trails with a slash mat consisting of fine material less than 3 inches in diameter and needles.
- Cable log
- Helicopter log

On slopes > 35 percent, the following options are acceptable:

- Cable log in summer or winter
- Helicopter log
- Pre-bunch logs only if the soils are snow covered
- All cable corridors would have slash placed so it covers > 50 percent of the ground after yarding operations are completed
- All corridors would have hand constructed waterbars installed at least 50 feet apart
- Logs would be skidded with their leading edge suspended

**High Burn Severity Rating:**

On slopes <35 percent (no units are in this situation) the following options are acceptable:

- All ground based skidding would operate in winter on snow or frozen ground.
- Helicopter or cable systems are acceptable

On slopes > 35 percent the following options are acceptable:

- Helicopter log any season
- Cable log in winter on snow or frozen ground
- Ground based equipment is not acceptable

- Mechanical pre-bunching is not allowed

Other management practices to protect soil from erosion and maintain soil productivity include the following:

- a) Winter logging would be done when the ground has enough snow or is frozen enough so operations do not cause wet muddy soil to bleed into the snow or appear in the tracks.
- b) Fine branches and foliage would be left in the units. This practice has two purposes; 1) to provide ground cover that reduces soil erosion rates and, 2) to provide nutrients. Whole tree yarding is not acceptable.
- c) Ideally, a slash mat would be six inches thick and constructed of the fine branches and twigs and needles removed during processing. Small tops less than 3 inches in diameter are also suitable. Log sized material is less well suited to protecting the soil from detrimental impacts.
- d) Both large woody debris (stems greater than 3 inches in diameter) and fine organic matter would be left on the harvest sites. Snags, live trees, larch greater than 18 inches in diameter, and non-merchantable trees would be left in the units.
- e) If mechanical fuel treatments are deemed necessary they would be accomplished with excavators to reduce soil disturbance.
- f) Specific actions related to noxious weed concerns include the following:
  - ☐ Minimize ground disturbance by using helicopters, skyline cable systems, and other mechanized equipment that has proven capability to be “light on the land” (such as rubber tired skidders or feller/bunchers).
  - ☐ Use mechanized equipment only on areas where terrain and soil conditions would cause minimal impact to soils (slopes generally less than 35%).
  - ☐ Operate equipment only when soils are at an acceptable level of dryness.
  - ☐ Designate main skid trails and temporary access roads and/or lay down treetops and limbs on these trails to protect the soil during skidding operations.
  - ☐ Wash all off-road equipment before entering the area and upon moving between sites on the Flathead National Forest.
  - ☐ Re-establish vegetation on bare ground created by road decommissioning or timber harvest activity, using native material where appropriate and available.

**EFFECTIVENESS:** High - Experience of local expert, [obvious by reasoned, logical response or observation]

**IMPLEMENTATION:** The following features would be designated on the Timber Sale Area Map:

1. Post-Fire Project Specific BMPs would be implemented primarily with the use of timber sale contract clause CT6.4, or other appropriate contract provisions.
-

**PRACTICE 14.03 - Use of Sale Area Maps for Designating Soil and Water Protection Needs**

**MONTANA BMPs: IV A 1.**

**OBJECTIVE:** To delineate the location of protection areas and special treatment areas, to ensure their recognition, proper consideration, and protection on the ground.

**EFFECTIVENESS:** High [obvious by reasoned, logical response or observation]

**IMPLEMENTATION:** The following features would be designated on the Timber Sale Area Map:

1. Stream courses (perennial and intermittent) to be protected under contract clause BT6.5
2. Special treatment zones (STZS) as needed as per contract clause CT6.62 (site specific wetland protection measures).

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**PRACTICE 14.10 - Log Landing Location and Design**

**PRACTICE 14.11 - Log Landing Erosion Prevention and Control**

**PRACTICE 14.12 - Erosion Prevention and Control Measures During Timber Sale Operations**

**PRACTICE 14.13 - Special Erosion Prevention Measures on Areas Disturbed by Harvest Activities**

**PRACTICE 14.14 - Revegetation of Areas Disturbed by Harvest Activities**

**PRACTICE 14.15 - Erosion Control on Skid Trails**

**MONTANA BMPs: III A 1,3, 6; III B 1, 6; IV A 5, 6; IV B 4, 5, 6.**

Landings:

- a) During periods of use, landings would be maintained in such a manner that debris and sediment are not delivered to any streams.
- b) Landings would drain in a direction and manner that would minimize erosion and would preclude sediment delivery to any stream.
- c) Standard Timber Sale Contract provision B6.64 Landings requires that after landings have served the Purchaser's purpose, the Purchaser shall ditch or slope them to permit water to drain or spread. Landings would be seeded as needed with a mix approved by the Forest Soil Scientist.

Skid Trails:

- a) Skid trails would be water-barred, the location and spacing would be designated by the Sale Administrator (SWCP 15.25).
- b) Skid trails likely to produce sediment would be covered with slash and/or seeded with a mix of seed and fertilizer specified in CT6.601.

**POST FIRE PROJECT SPECIFIC BMPs for all applicable landings and units:**

1. Helicopter landings would be located on flat areas away from streams and outside the cutting units. The Helicopter landings would be ripped and seeded following use. In some cases roads may be used as helicopter landings.

2. Install waterbars or place slash or do both as needed to control overland flow and erosion on all skid trails at the completion of the project.
3. All skyline corridors would have waterbars installed. On cable yarding corridors lay treetops and limbs/slash on the ground in those areas where logs make contact with the ground, leaving areas of bare soil.

**OBJECTIVE:** To protect water quality by minimizing erosion and subsequent sedimentation derived from log landings and skid trails.

**EFFECTIVENESS:** High (experience of the soil scientist, sale administrator, and ID Team members are that these requirements and criteria are highly effective in minimizing soil erosion)

**IMPLEMENTATION:** Standard Timber Sale provision BT6.6 requires the purchaser to conduct operations in a reasonable fashion to minimize erosion. Additionally, specific erosion requirements would be spelled out in provisions such as CT6.4, CT6.6, CT6.601, CT6.62, and CT6.623. The following criteria would be used in controlling/minimizing erosion, restoring landings and skid trails. Post Fire Project Specific BMPs would be implemented primarily with the use of timber sale contract clause CT6.4, or other appropriate contract provisions.

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#### **PRACTICE 14.18 - Erosion Control Structure Maintenance**

**MONTANA BMPs:** III E 2,8; IV B 4, 6.

**OBJECTIVE:** To ensure that constructed erosion control structures are stabilized and working effectively.

**EFFECTIVENESS:** High (experience of the soil scientist, sale administrator, and ID Team members are that the following requirement is highly effective in minimizing soil erosion)

**IMPLEMENTATION:** Timber Sale Contract provision, BT6.66, requires that during the period of the contract, the Purchaser shall provide maintenance of soil erosion control structures constructed by the Purchaser until they become stabilized. The Forest Service may agree to perform such structure maintenance under BT4.228 Cooperative Deposits, if requested by the Purchaser, subject to agreement on rates. Should the Purchaser fail to do seasonal maintenance work, the Forest Service may assume the responsibility and charge the Purchaser accordingly. The Timber Sale Administrator would ensure that erosion control structures are working effectively.

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#### **PRACTICE 14.19 - Acceptance of Timber Sale Erosion Control Measures Before Sale Closure**

**MONTANA BMPs:** III C 8; VI B 6;

**OBJECTIVE:** To assure the adequacy of required erosion control work on timber sales.

**IMPLEMENTATION:** Timber Sale Contract provision, BT6.36, requires that upon the Purchaser's written request and assurance that contract work has been completed; the Forest Service shall perform an acceptance inspection. For erosion control work, "acceptable" means only minor deviation from established standards, provided no major or lasting impact is

caused to soil and water resources. The Timber Sale Administrator would not accept as complete, any erosion control work that does not meet this criteria.

**EFFECTIVENESS:** High [obvious by reasoned, logical response or observation]

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## **PRACTICE 15.06 - Mitigation of Surface Erosion and Stabilization of Slopes**

**MONTANA BMPs: III E 8.**

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# **BEST MANAGEMENT PRACTICES FOR FORESTRY IN MONTANA**

**December 1997**

**(Revision of 1988 BMPs to include SMZ law requirements)**

## **I. DEFINITIONS**

1. "Hazardous or toxic material" means substances which by their nature are dangerous to handle or dispose of, or a potential environmental contaminant, and includes petroleum products, pesticides, herbicides, chemicals, and biological wastes.
2. "Stream," as defined in 77-5-302(7), MCA, means a natural water course of perceptible extent that has a generally sandy or rocky bottom or definite banks and that confines and conducts continuously or intermittently flowing water.
3. "Streamside Management Zone (SMZ)" or "zone" as defined at 77-5-302(8), MCA means "the stream, lake, or other body of water and an adjacent area of varying width where management practices that might affect wildlife habitat or water quality, fish, or other aquatic resources need to be modified." The streamside management zone encompasses a strip at least 50 feet wide on each side of a stream, lake, or other body of water, measured from the ordinary high water mark, and extends beyond the high water mark to include wetlands and areas that provide additional protection in zones with steep slopes or erosive soils.
4. "Wetlands" mean those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include marshes, swamps, bogs, and similar areas.
5. Adjacent wetlands are wetlands within or adjoining the SMZ boundary. They are regulated under the SMZ law.
6. Isolated wetlands lie within the area of operation, outside of the SMZ boundary, and are not regulated under the SMZ law.

## **II. STREAMSIDE MANAGEMENT**

The Streamside Management Law (77-5-301 through 307 MCA) provides minimum regulatory standards for forest practices in streamside zones (SMZ). The "Montana Guide to

Streamside Management Zone & Rules” is an reference to describe management opportunities and limitations within SMZ’s.

### **III. ROADS**

#### **A. Planning and Location**

1. Minimize the number of roads constructed in a watershed through comprehensive road planning, recognizing intermingled ownership and foreseeable future uses. Use existing roads, unless use of such roads would cause or aggravate an erosion problem.
3. Fit the road to the topography by locating roads on natural benches and following natural contours. Avoid long, steep road grades and narrow canyons.
6. Locate roads to provide access to suitable (relatively flat and well-drained) log landing areas to reduce soil disturbance.

#### **B. Drainage from Road Surface**

1. Provide adequate drainage from the surface of permanent roads. (a) Outsloped roads provide a means of dispersing water in a low energy flow from the road surface. Outsloped roads are appropriate when the fill slopes are stable, drainage would not flow directly into a stream channel, and transportation safety can be met.
4. Provide energy dissipaters (rock piles, slash, log chucks etc.) where necessary to reduce erosion at outlets of drainage features.
6. Route road drainage through adequate filtration zones or other sediment structures to ensure sediment doesn’t reach surface water. Install road drainage features above stream crossings to route discharge into filtration zones before entering a stream. Route road drainage through adequate filtration zones or other sediment-settling structures to ensure sediment doesn’t reach surface water. Install road drainage features above stream crossings to route discharge into filtration zones before entering stream (*applies to the access road on the private land*).

#### **C. Construction**

1. Keep slope stabilization, erosion and sediment control work current with road construction. Install drainage features as part of the construction process, ensuring that drainage structures are fully functional. Complete or stabilize road sections within same operating season.
2. Stabilize erodible, exposed soils, by seeding, compacting, riprapping, benching, mulching, or suitable means.
8. Place debris, overburden, and other waste materials associated with construction and maintenance activities in a location to avoid entry into streams. Include these waste areas in soil stabilization planning for the road.

#### **E. Maintenance**

2. Maintain erosion control features through periodic inspection and maintenance, including cleaning dips, and crossdrains, repairing ditches, marking culvert inlets to aid in location, and clearing debris from culverts.
8. Upon completion of seasonal operations, ensure that drainage features are fully functional. The road surface should be crowned, outsloped, insloped, or water-barred. Remove berms from the outside edge where runoff is channeled.

## **IV. TIMBER HARVESTING AND SITE PREPARATION**

### **A. Harvest Design**

1. Plan timber harvest in consideration of your management objectives and the following:
  - a) Soils and erosion hazard identification.
  - b) Rainfall.
  - c) Topography.
  - d) Silvicultural objectives.
  - e) Critical components (aspect, water courses, landform, etc.).
  - f) Habitat types.
  - g) Potential effects on water quality and beneficial water uses.
  - h) Watershed condition and cumulative effects of multiple timber management activities on water yield and sediment production.
  - i) Wildlife habitat.
1. Use the logging system that best fits the topography, soil type, and season, while minimizing soil disturbance and economically accomplishing silvicultural objectives.
3. Use the economically feasible yarding system that would minimize road densities.
4. Design and locate skid trails and skidding operations to minimize soil disturbance. Using designated skid trails is one means of limiting site disturbance and soil compaction. Consider the potential for erosion and possible alternative yarding systems prior to planning tractor skidding on steep or unstable slopes.
5. Locate skid trails to avoid concentrating runoff and provide breaks in grade. Locate skid trails and landings away from natural drainage systems and divert runoff to stable areas. Limit the grade of constructed skid trails on geologically unstable, saturated, highly erosive, or easily compacted soils to a maximum of 30%. Use mitigating measures, such as water bars and grass seeding, to reduce erosion on skid trails.
6. Minimize the size and number of landings to accommodate safe, economical operation. Avoid locating landings that require skidding across drainage bottoms.

### **B. Other Harvesting Activities**

1. Tractor skid where compaction, displacement, and erosion would be minimized. Avoid tractor or wheeled skidding on unstable, wet, or easily compacted soils and on slopes that exceed 40% unless operation can be conducted without causing excessive erosion. Avoid skidding with the blade lowered. Suspend leading ends of logs during skidding whenever possible.
4. For each landing, provide and maintain a drainage system to control the dispersal of water and to prevent sediment from entering streams.
5. Ensure adequate drainage on skid trails to prevent erosion. On gentle slopes with slight disturbance, a light ground cover of slash, mulch or seed may be sufficient. Appropriate spacing between water bars is dependent on the soil type and slope of the skid trails. Timely implementation is important.

6. When existing vegetation is inadequate to prevent accelerated erosion, apply seed or construct water bars before the next growing season on skid trails, landings and fire trails. A light ground cover of slash or mulch would retard erosion.

#### C. Slash Treatment and Site Preparation

1. Rapid reforestation of harvested areas is encouraged to reestablish protective vegetation.
2. When piling slash, care should be taken to preserve the surface soil horizon by using appropriate techniques and equipment. Avoid use of dozers with angle blades.
5. Carry out brush piling and scarification when soils are frozen or dry enough to minimize compaction and displacement.
7. Remove all logging machinery debris to proper disposal site.
8. Limit water quality impacts of prescribed fire by constructing water bars in firelines; not placing slash in drainage features and avoiding intense fires unless needed to meet silvicultural goals. Avoid slash piles in the SMZ when using existing roads for landings.

## VI. WINTER LOGGING

#### A. General

2. Conduct winter logging operations when the ground is frozen or snow cover is adequate (generally more than one foot) to prevent rutting or displacement of soil. Be prepared to suspend operations if conditions change rapidly, and when erosion hazard becomes high.

## VII. HAZARDOUS SUBSTANCES

#### A. General

1. Know and comply with regulations governing the storage, handling, application (including licensing of applicators), and disposal of hazardous substances. Follow all label instructions.
2. Develop a contingency plan for hazardous substance spills, including cleanup procedures and notification of the State Department of Environmental Quality.

#### B. Pesticides and Herbicides

1. Use an integrated approach to weed and pest control, including manual, biological, mechanical, preventive, and chemical means.

## BMP EFFECTIVENESS

### Best Management Effectiveness

BMP audits have occurred on the Flathead National Forest and Kootenai National Forests since 1988. Audits are a form of monitoring BMPs to determine if they were properly applied and if so were they effective at preventing soil or water impacts. Since 1988, individual BMPs have been audited or monitored 2232 times on the Flathead and Kootenai National Forests. They were effective 2211 times. The Kootenai and Flathead National Forests were grouped together because they have similar climates and similar soils.

In order to analyze the results of the BMP audits they were grouped according to the soil type on which they occurred. The simplest way is to group them by either residual soils that formed from the underlying bedrock, or soils formed from glacial till. Looking at these soil criteria, BMPs were effective when properly applied on glacial soils 1585 times out of 1596 applications. BMPs were effective when properly applied on residual soils 154 out of 156 applications. An additional 480 BMPs were monitored without reference to the soil types on which they were applied. Of these, 472 were effective at protecting soil and water quality.

In summary, BMPs were effective 99.3 percent of the time they were properly applied on glacial till soils. They were effective 98.7 percent of the times they were properly applied on residual soils. Lumping all the audit results together regardless of their soil types and including the earliest audits that were not specific to soil type, BMPs were effective 99 percent of the time they were properly applied on the Flathead and Kootenai National Forests.

On an individual BMP basis, no particular BMP stood out as an ineffective practice to maintain soil and water quality. However, there are a few that were less than 100 percent effective when properly applied on soils formed in glacial till, the major soil type in the project area. These include the following:

- Roads planning and location, BMP IIIA3, Fit road to the topography. This BMP was effective 95 percent of the time it was properly applied (21 out of 22 times). No new roads are planned for the Moose project.
- Road construction, BMP IIIC1, keep slope stabilization, erosion and sediment control work current with road construction. This BMP was effective 93 percent of the time it was properly applied (25 out of 27 times). No new roads are planned for the Moose project.
- Road construction, BMP IIIC2, Stabilize erodable exposed soils by seeding etc. This BMP was effective 87 percent of the time it was properly applied (39 out of 45 times). No new roads are planned for the Moose project.
- Site Preparation, BMP IVC5, carry out brush piling and scarification when soils are frozen or dry enough to minimize compaction and displacement. This BMP was effective 89 percent of the time it was properly applied (8 out of 9 times).
- Hazardous Substances, BMP VIIA1, know and comply with regulations governing storage, handling, application and disposal of hazardous substances. This BMP was effective 92 percent of the time it was properly applied (11 out of 12 times). It is most commonly applied to the handling of fuel and oil.

A copy of the summaries this is based on and which specific BMPs they refer to is available in the project record exhibit N-25

## LITERATURE CITED

U.S. Environmental Protection Agency. 1987. Nonpoint Source Controls and Water Quality Standards. Washington, D.C.

APPENDIX E: Monitoring Plan for Fish, Soil, and Water

## INTRODUCTION

The purpose of this monitoring plan is to provide feedback on the environmental effects of post fire management actions on the soil, water, and fisheries resources in the Robert – Wedge Post-fire Project in the North Fork of the Flathead River watershed. The information generated in this monitoring plan will aid in determining trend conditions, project effects, Best Management Practices compliance, and compliance with soil and fisheries standards.

## MONITORING STRUCTURE

Figure 48 is a flowchart depicting the key steps in the Robert – Wedge Post Fire Project EIS Monitoring Plan based on guidelines developed for Region 10 of the U.S. Environmental Protection Agency. These guidelines are published in *Monitoring Guidelines to Evaluate Effects of Forestry Activities on Streams in the Pacific Northwest and Alaska* (MacDonald, 1991<sup>5</sup>). This step-by-step process identified by MacDonald forms the framework for the Robert -Wedge Post Fire Project Monitoring Plan.

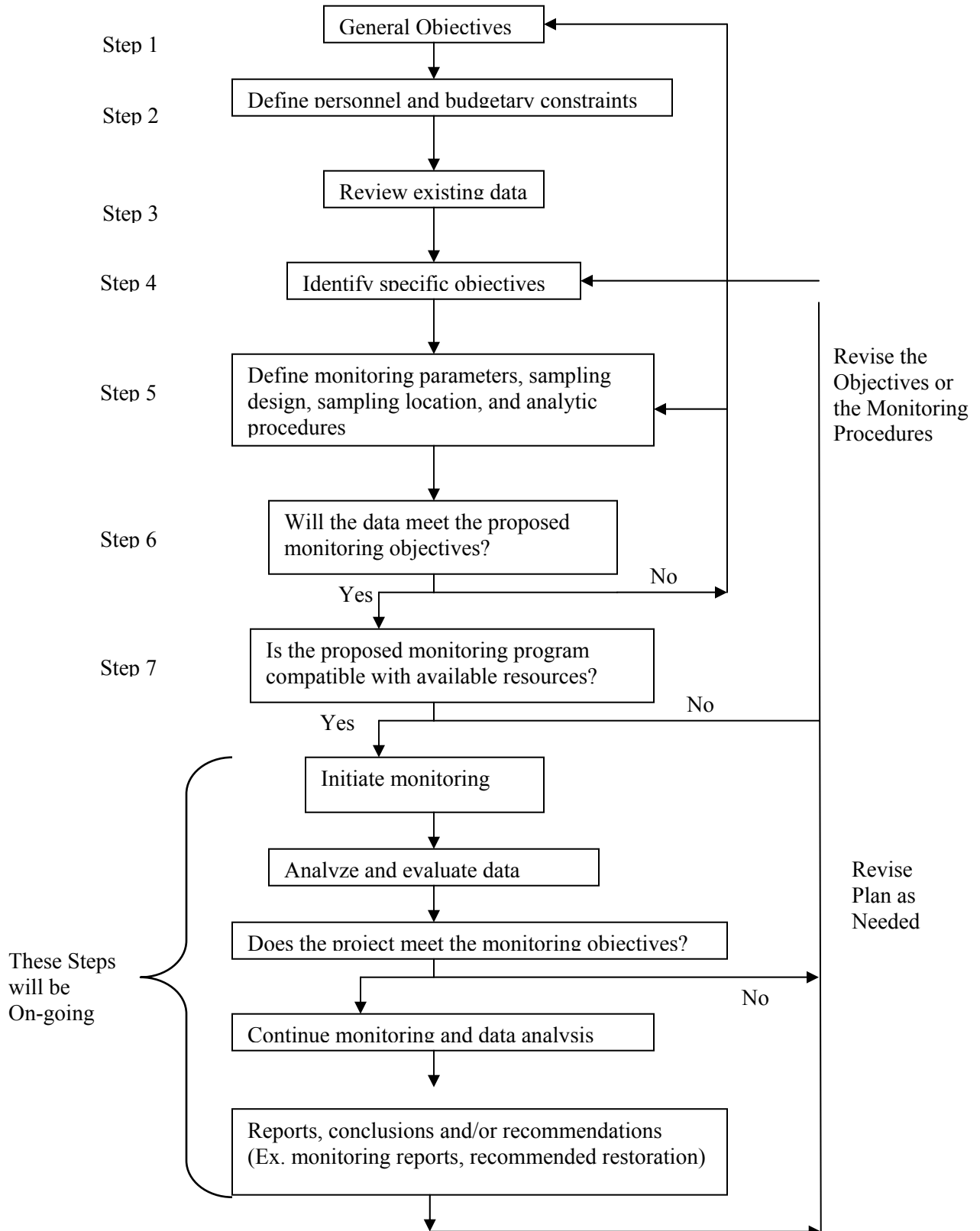
Each key step in the flow chart will be addressed separately. As new information or techniques become available, the feedback loops in the plan will be used to keep the monitoring plan allied with the general and specific monitoring objectives. This means that the monitoring locations, parameters, frequency, and analytic techniques are free to adapt to new information and/or budgetary constraints.

In addition to key steps, the monitoring plan also contains critical feedback loops that are necessary to keep the monitoring plan relevant and linked to the general and specific monitoring objectives. The order in which the steps of the monitoring plan are carried out is less important than the need for each key step to be explicitly addressed in the development and evolution of the monitoring plan.

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<sup>5</sup> MacDonald, Lee H. 1991. *Monitoring Guidelines to Evaluate Effects of Forestry Activities on Streams in the Pacific Northwest and Alaska*, Guidelines developed for Region 10, Environmental Protection Agency, Seattle, Washington, under EPA Assistance No. CX-816031-01-0.

**Figure 48. Robert-Wedge EIS Monitoring Plan Flow Chart and Process Steps.**



## DISCUSSION OF KEY MONITORING STEPS

### Step 1 - General Objectives

The first step in the monitoring plan is the identification of the general monitoring objectives. The objectives are done with interdisciplinary and interagency participation. Once the general monitoring objectives have been established and agreed upon, the remainder of the monitoring effort will continually be measured against these objectives.

The following are the proposed indicators of desired condition for assessment of fish habitat, soil, and water quality:

- The desired condition for cold-water fishery habitat is for interstitial fine sediments not to be a limiting factor to fish reproduction and survival in any of the streams in the project area. The key indicator for this objective would be the amount of interstitial fine sediments occurring in the fish-spawning habitat, as measured using the McNeil Core methodology.
- The desired condition of the soil resource is that minimal detrimental soil impacts are present after harvesting activities, and the soil productivity is maintained. This includes adequate coarse woody debris to maintain soil nutrient cycling.
- The desired condition in the Robert -Wedge Post Fire project area is for stream channels to be in or approaching equilibrium; i.e., have minimal channel erosion or sediment deposition. The key indicator for this objective would be to measure the same amount of streambank erosion occurring within sensitive reaches.
- The desired condition for the upland (ground surface between stream channels) would be to have a vegetation cover (grass, forbs, and brush) or to have a rock surface armoring, thereby not being a sediment source. Minimizing detrimental soil conditions and maintaining soil productivity are desired elements relative to soil resources. The key indicators for these objectives would be identifying and restoring sediment sources and detrimental soil conditions.

### Specific Monitoring Objectives for the Robert–Wedge Post Fire Project

*Objective 1* - Monitor salvage logging units (ground based – tractor logged) to measure the amount of detrimental soil disturbance and develop post-salvage soil disturbance restoration plan if detrimental disturbance is equal to or exceeds 15 percent. Detrimental soil disturbance includes soil compaction, displacement, rutting, puddling, and erosion.

*Objective 2* - Monitor Whale Creek, and other key fishery streams, to determine the effects of the wildfire and the post-fire salvage to fish habitat and assess the status of INFISH Riparian Management Objectives.

*Objective 3* - The most common use of implementation and effectiveness monitoring is to determine whether Best Management Practices (BMPs) were implemented as specified and whether individual BMPs were effective in preventing adverse water quality impacts. As part of BMP monitoring, we would also determine if the applicable Streamside Management Zone (SMZ) rules were implemented.

*Objective 4* - Monitor a sample of the salvage-logging units, both ground based and aerial logged, to measure the amount of remaining coarse woody debris remaining on site after the salvage activities. This is to determine if adequate amounts of down wood is remaining in the salvage units to meet the targets set in Amendment 21 for soil nutrient cycling. At the same time determine if there is excess hazardous ground fuel loads. This coarse woody debris monitoring can be done concurrently with the soil disturbance monitoring.

*Objective 5* - Monitor Whale Creek and McGinnis Creek stream channels to determine the amount of post-fire/post-harvest channel erosion or sediment deposition that is occurring.

## Step 2 - Personnel and Budgetary Constraints

Once the general objectives have been made (Step 1), the approximate personnel and budgetary constraints must be specified in order to ensure that the subsequent monitoring plan is realistic. Funds for environmental monitoring is provided through a variety of sources.

Annual funding allocated to monitoring on the Flathead NF for soil, water, and fisheries programs amounts to approximately twenty-two thousand dollars (\$22,000). The following table displays the budgetary constraints of discretionary funding for annual monitoring activities of these three programs.

**Table 167. Annual Funding Available for Fish, Soil, and Water Monitoring on the Flathead National Forest.**

1) Monitoring Program	2) Annual Discretionary Monitoring Funds
Soils Monitoring	\$5,000
Hydrology Monitoring	\$2,000
Fisheries Monitoring	\$15,000

The funding available is based on present budget appropriations and Forest-wide priorities. Significant changes within the next 2 years are not expected to occur. Longer-term funding levels (2 years +) are less secure and subject to changes in national and regional priorities.

## Step 3 - Review of Existing Data

Chapter 3 of this document contains discussions of the pertinent existing data pertaining to soils, streams, and fish habitat in the project area. Herein is a short description of the existing monitoring data and the sampling procedures proposed to be used to monitor post-salvage effects to those resources.

### Soil Quality Monitoring

Existing soils monitoring data for the Robert-Wedge Post Fire Project area is limited to past harvest areas that are proposed for salvage units. This soil monitoring is done this summer (2004) to determine how much of a past activity areas have had detrimental soil disturbance. Also, numerous cutting units have been monitored across the Flathead National Forest on soil similar to those in the Robert-Wedge Post Fire Project Area. The information from that monitoring would be applicable to the activities on the Robert-Wedge Post Fire Project area. The results are summarized in the Land and Resource Management Plan Annual Monitoring Reports.

### **Stream Channel Monitoring**

The Whale Creek Watershed has been examined through TMDL monitoring programs in the past two years. During that process Pfankuch stream channel rating, stream cross-sections, and Wolman pebble counts were completed at several sites. These same data parameters were monitored in McGinnis Creek in the fall of 2003 following the wildfire. This section discusses the relevant stream and water quality data for Whale Creek that characterize the existing condition.

Following the Moose Post-Fire Project, stream reaches in Big Creek were sampled using these same procedures. The monitoring in Big Creek can be used to show the effects of wildfire and post-fire salvage activities in a geographically similar setting to streams in the Robert Fire.

### **Bull Trout Habitat Monitoring**

McNeil Core samples collected by Montana Fish, Wildlife, and Parks is part of the overall bull trout monitoring program partially funded by the Forest Service. Bull trout redd counts are completed annually in the vicinity of the McNeil Core samples and numbers of juvenile bull trout in these areas are also documented. This monitoring has been done in the past in past in Whale Creek and Big Creek. The monitoring in Big Creek can be used to show the effects of wildfire and post-fire salvage activities in a geographically similar setting to streams in the Robert Fire. This trend monitoring is expected to continue and will provide additional important information to help assess conditions in the watershed.

## **Step 4 - Specific Objectives**

This step involved participation of both managers and technical staff in order to ensure that the specific objectives are technically and financially feasible. Specific objectives were carefully identified and described. Previous monitoring efforts as well as the likely impacts of the management actions were assessed.

The site-specific objectives for this plan are given in the following table:

**Table 168. Specific Monitoring Objectives.**

Monitoring Parameter	Objectives
Soils – Soil Quality Monitoring	Measure the amount and location of detrimental soil disturbance in representative salvage units. Emphasis will be placed on proposed units that would be managed a second time with ground based harvest equipment. Measure post-harvest coarse woody debris in harvest units.
Soils – BMP Implementation Monitoring	Evaluate the implementation and effectiveness of BMPs including the application of Streamside Management Zone rules.
Stream Channel Condition Monitoring	Track the geomorphic conditions (erosion/deposition) at representative stable and unstable reaches.

Monitoring Parameter	Objectives
McNeil Core Substrate Monitoring	Track condition of key fishery habitat.
INFISH – Riparian Management Objectives	Determine the status of fish habitat relative to INFISH RMOs.

### **Step 5 - Sampling Locations, Monitoring Parameters, Sampling Frequency, and Analytic Procedures**

This step involves identifying specific techniques, locations, and analysis tools to meet both the specific (Step 4) and general (Step 1) monitoring objectives.

This step would involve the Montana Fish Wildlife and Parks, the U.S. Fish and Wildlife Service, and the U.S. Environmental Protection Agency.

Various techniques are proposed to monitor the condition of soil, water, and fisheries in Robert – Wedge Canyon Project area:

- The Forest Service would review the effectiveness of the BMP/erosion control practices during the second year following implementation of the control practices. Additional monitoring of Streamside Management Zones and INFISH RHCA buffers would also be completed as a portion of the BMP audits. In addition, if the Robert–Wedge Post Fire Project is implemented it would be eligible to be selected for inclusion in the State BMP audits in the summer of 2006.
- Forest Service personnel would measure the amount of detrimental soil disturbance by following the procedures outlined in the Proposed Soil Resource Condition Assessment by Steve Howes. This process was used to determine the existing condition of proposed units that had undergone previous management activities.
  - One helicopter unit and one cable harvest unit would be monitored. All literature indicates that these logging systems have low impact on soils as supported by past monitoring on the Flathead National Forest. These logging systems are low priority for monitoring. Therefore, only a representative sample of units would be monitored.
  - Twenty percent of the units proposed for ground-based logging would be monitored. All previously managed units that have summer tractor logging implemented in the decision on this project would also be monitored.
  - Monitoring would occur following complete implementation of the project. During implementation, the sale administrator would monitor site and soil characteristics to ensure that the terms of the contract are met as it relates to design features that protect soil quality.
- A combination of channel cross-sections, and Wolman pebble counts would be used to quantify the amount of fine sediments and streambank erosion occurring in the stream channels downstream of post-fire salvage areas. Monitoring sites would

be located above, below, and within sensitive stream reaches. The Forest Service would monitor these sites on a bi-annual basis for several years.

- The McNeil Core procedure would be used to measure amounts of substrate fine sediments in the stream channels of Whale Creek and Big Creek. Also, Montana Fish, Wildlife and Parks will continue to do annual bull trout redd counts and juvenile abundance estimates within the index reaches of the Whale Creek and Big Creek watershed.
- Forest Service fisheries biologist would determine the status of fish habitat relative to INFISH Riparian Management Objectives (RMOs) in a sample of streams in the Robert–Wedge Post Fire Project area following the salvage activities. R1/R4 inventory methods would be used to measure pool size and abundance, the amount of large woody debris, substrate size, and channel stability.

Tiering to the general and specific monitoring objects for the Robert–Wedge Post Fire Project watersheds and the potential threats to soil productivity, fishery habitat, and water quality, specific monitoring parameters were selected and are displayed in Table 169.

**Table 169. Monitoring Parameters, Frequency, and Costs.**

Monitoring Parameter	Number of Sites	Frequency/Yr	Program Costs	Equip/labor/analysis Costs/Yr (Discretionary Funds)
Soils – Soil Quality Monitoring/ CWD	20% Tractor Salvage Harvest Units	Post-harvest - once	Soils – 100%	\$2000
Soils – BMP Implementation Monitoring	10-15 % of harvest units & roads accessing units	Post-harvest – once (with possible State audits in addition)	Soils – 33% Hydro – 33% Fish – 33%	\$1500
Water – Channel Condition Monitoring	3-4	Bi-annually 8-10 year duration	Hydro – 100%	\$1000
Fish Habitat – McNeil Core	4	Annually	Fish – 100%	\$1500
INFISH – Riparian Management Objectives (RMO's)	2-3 Selected Reaches	Initially Post-harvest and 3-4 years later	Fish – 100%	\$1500

### **Steps 6 and 7- Comparing Monitoring Plan with Objectives and Budget**

To meet the general and specific objectives of this monitoring plan, the following data collection costs are anticipated. Comparing the proposed monitoring parameters and their associated costs with the personnel and budget constraints lends the following comparison:

**Table 170. Budget Comparison.**

Monitoring Program	Proposed Plan	Discretionary Monitoring Budget Constraints
Soils Monitoring	\$2500	\$5000
Hydrology Monitoring	\$1500	\$2000
Fisheries Monitoring	\$3500	\$15,000

This budget comparison indicates that the proposed budget of \$22,000/year of discretionary monitoring funding would be sufficient to cover the costs of this \$7,500 monitoring plan.

The Flathead National Forest has had a commitment for over two decades to monitor the effects of management activities on soil, water, and fish resources, and this emphasis in the allocation of out-year budgets to accomplish this workload is expected to continue.

The scope of this proposed plan is appropriately designed to accomplish the monitoring objectives in a realistic and efficient manner. The budget comparison reveals that all items can be accomplished within available personnel and budget constraints.

## Post-fire Salvage in the Robert and Wedge Canyon Fire Areas

### Introduction

The over-riding goal for what is left after salvage is to leave a diversity of conditions while working with natural pre-fire variations in vegetation, as well as the variation in fire severities. The silvicultural prescriptions for salvage would use “designation by description” to accomplish these management objectives much more cost effectively. This involves designating the trees to leave or cut by using a combination of criteria such as species and diameters, in lieu of marking individual trees with paint. Table 171 applies to all units. Table 172 applies additional aspects to three classes of salvage units, based on a variety of features, such as their juxtaposition to nearby snag habitats and to open roads. A site-specific analysis of snags was done for the post-fire project areas in accordance with Amendment 21. Therefore, the minimum numerical standards for snags offered in Appendix A (page 27) of Amendment 21 do not apply to these projects. Safety is a critical consideration in developing these prescriptions, which follow the USFS R1 reserve tree guide. More detailed rationale is provided below.

### Prescriptions

**Table 171. Prescriptions Applicable to all Harvest Units.**

Element	Prescription for all parts of all units.	Rationale
Live trees of all species	Leave all standing, wherever feasible. Design unit layout to avoid taking live trees for safety concerns, landings, and trails. The definition of “live trees” varies by species, size, and condition. This will be detailed in an appendix to the EIS.	Live trees provide many ecological functions, as well as the recruitment of future snags.
Green trees and snags that would have been retained but were felled due to hazards.	Retain felled hazard trees on-site, with as little bucking as possible. Within 200 feet of an open road, only merchantable portions may be removed.	Retain for down wood. The larger the log the more valuable it is to wildlife as well as other resources, and the less of a fire hazard.
Wildlife Snags over 18” DBH with nest holes, broken top, conks, or pre-fire decay	Leave all standing wherever safe to do so. Western larch snags with nest cavities may be safely retained dispersed in a unit, due to the solid and durable nature of its sapwood. Wildlife snags will be protected to the extent possible when designing units on the ground.	Snags $\geq 18$ with broken tops, cavities and/or decay prior to the fire are strongly selected for by cavity using wildlife.

Element	Prescription for all parts of all units.	Rationale
Unmerchantable snags, all species and sizes	Leave all standing, wherever safe to do so, unless they are in the wildland urban interface.	To allow for the natural recruitment of down wood over time, and to help retain security for wildlife.
Black Cottonwood, aspen, paper birch, and ponderosa pine snags	Leave all standing, wherever safe to do so. Design unit layout to avoid felling these for safety concerns, landings, and trails. Extremely few, if any, of these species are expected in these fire areas.	These tree species are highly preferred by wildlife.
Coarse Woody Debris	Default A21 course woody debris standards for Moist PVG will be retained in treatment areas where it is available. This is provided by unmerchantable pre-fire downed wood, un-merchantable material left standing, later windfall of leave trees and leave snags, and felled hazard or un-merchantable trees. Standards: Retain coarse woody debris (woody pieces > 6 feet in length) in treatment areas at these densities: 32 pieces average per acre 9 to 20 inches diameter and 15 pieces average per acre $\geq$ 20 inches diameter	Hydrologists and soil scientists determined these standards were appropriate for these fire areas. It also retains adequate numbers and distribution of large downed logs for wildlife.

Snag Emphasis Levels (Table 172) will be based on the size and shape of each proposed unit and its juxtaposition to:

- Motorized roads open to the public yearlong or seasonally.** Parts of all units within 200 feet of open roads are included in the low emphasis level, because much of the dead wood left is expected to be removed as firewood.
- Other proposed salvage units.** The snag emphasis level would typically be raised for a unit with a considerable amount of timber salvage nearby, or one that is part of a large complex of contiguous units.
- The amount of large-diameter (>20" DBH) larch and Douglas fir snags that are not in salvage units.** In general, a unit with a considerable amount of desirable snag habitat nearby would go in the low or moderate category. However, if areas of good snag habitat are small or rare across a fire area, such a unit could get a high snag emphasis level.

- d) **Units in areas with few big larch snags, such as spruce-fir or pole-sized stands, or past regeneration harvest units.** The snag emphasis level would typically be raised for this type of unit.
- e) **Areas that seem to be important movement corridors for wildlife, such as riparian areas or ridges.** The snag emphasis level would typically be raised for this type of unit.
- f) **Burned-up, underburned, and unburned old growth.** The snag emphasis level would typically be raised for a unit in burned-up old growth habitat, as with a unit adjacent to underburned or unburned old growth.
- g) **Burn severity.** Some severely burned units would be placed in the high emphasis level, due to lack of green replacement snags. Low-severity fire in what was a dense stand of larch might put a unit in the low or moderate emphasis level.

Each fire area may have additional factors that affect snag emphasis levels, such as adjacency to other ownerships.

**Table 172. Prescriptions based on Snag Emphasis Level.**

Element	Prescription by Snag Emphasis Level			Rationale
	1 ("High")	2 ("Moderate")	3 ("Low")	
Western Larch Snags <sup>1</sup>	Wherever safe, leave standing all $\geq 20''$ DBH and $\geq 10$ feet tall.	Wherever safe, leave standing all $\geq 22$ DBH and $\geq 10$ feet tall.	Leave only if have holes or decay (wildlife snags). Paint and sign snags if within 200 feet of an open road.	Western larch is highly preferred by cavity users and for foraging. $\geq 20''$ DBH nest trees are very important for pileated woodpecker nesting. Many secondary cavity users are dependent of pileated woodpecker holes.
Douglas-fir Snags <sup>1</sup>	Wherever safe, leave standing all $\geq 23$ DBH and $\geq 10$ feet tall.	Wherever safe, leave standing all $\geq 23$ DBH and $\geq 10$ feet tall.	Leave only if have holes or decay (wildlife snags). Paint and sign snags if within 200 feet of an open road.	Douglas fir is preferred by cavity users and for foraging.

Element	Prescription by Snag Emphasis Level			Rationale
	1 ("High")	2 ("Moderate")	3 ("Low")	
Severely or moderately burned units smaller than or equal to 20 acres. <sup>2</sup>	Leave irregularly shaped reserve patches to bring the total to at least a minimum 10% of the unit acreage located around the largest snags where feasible. <sup>1</sup>	Additional reserve patches not required.	Reserve patches not required.	Due to the small size of these units, the retention of reserve patches was less valuable to wildlife than larger units.
Units larger than 20 acres that were: a) severely or moderately burned OR b) spruce dominated stands that burned at low intensity. <sup>2</sup>	Leave irregularly shaped reserve patches to bring the total to at least a minimum 25% of the unit acreage, located around the largest snags where feasible. <sup>1</sup>	Leave irregularly shaped reserve patches to bring the total to at least a minimum 15% of the unit acreage, located around the largest wildlife snags where feasible. <sup>1</sup>	Reserve patches not required.	Research has shown much higher use and nest success in post-fire salvage reserve patches as opposed to individual snags left scattered across the units. Low intensity burns in western larch and Douglas fir stands should have enough green trees to provide for natural snag recruitment.

<sup>1</sup> When possible, reserve patches will be placed within and adjacent to linear and patchy riparian areas, around unsafe large-diameter wildlife snags, on ridges, in and around archeological sites, in and around sensitive plant species areas within and adjacent to units, in blind leads and other inoperable areas, and adjacent to unburned or low intensity burn areas. Interior patches are preferable, particularly if they can be large.

<sup>2</sup> Acreage and percentages are based on original Proposed Action unit size. Reserve patches are to contain mainly snag habitat.

## Rationale

Scientific literature and experts in post-fire ecological processes, timber salvage systems, and safety were consulted to arrive at the components of these prescriptions.

Leaving these snags takes into account the potential for safety hazards to forest workers. Due to recent OSHA findings within Region 1, OSHA requirements will be more strictly followed than in the past. This will mean that substantially more snags may be felled due to safety concerns than have been in the past. Safety was a critical consideration in developing these prescriptions, which follow the USFS R1 reserve tree guide.

In areas where most trees were killed, it will take a minimum of 100 + years to recruit snags greater than 15 inches DBH, even if the sites are planted. This means that the snags retained in these burned units will be the only large diameter snags or down logs for at least a century. One must also consider that most of these units are within close proximity to areas that were previously harvested and contain limited to no large diameter snags. The retained snags will be the legacy structure. This makes it critical to retain sufficient numbers of snags to provide for variability and diversity within and between the salvage units. It should be noted that both the low severity burn (depending on the tree species) and unburned areas would continue to naturally recruit snags and down logs. In addition, many of the unburned areas have small inclusions of burn, which contain pockets of snags. This prescription retains a wide mix of snags numbers within burned and unburned areas.

The goal is to provide variability and diversity within and between the salvage units, using scientific knowledge of natural disturbance processes as a guide (Saab and Dudley 1998, Caton 1996, Hitchcock 1996). Snags are an important habitat component for wildlife, especially for cavity-using birds and mammals. These species use snags for nesting or denning, foraging, roosting, communication, or perching. Size (diameter and height), tree species, age (time standing since tree death) and condition, and location (exposure, microclimate, and surrounding habitat) are major factors that contribute to the relative value of individual snags to wildlife. The abundance of cavity-nesting birds, in particular, largely depends upon the abundance of suitable snags both for nesting as well as foraging. Successful management and conservation of snag-using wildlife depend upon maintenance of a sufficient number of large-diameter snags on a continuing basis.

Management practices will have negative effects on some species and ecological processes as well as positive effects on others. Leaving a diversity of conditions is the only way can ensure that all pieces will remain. Unharvested snags in areas outside USFS land cannot be relied upon to maintain viable populations of vertebrate species. In the NFMA viability requirement, “habitat must be well distributed so that those individuals can interact with others in the planning area”, which in our case is the Flathead National Forest. In addition, wildlife species and ecological processes essential to their survival occur at a wide range of spatial scales, from microsites to ecoregions.

Cavity nesting birds, which comprise approximately 25% of the area’s forest bird species, are greatly influenced by forest composition and structure (McClelland 1979, Raphael and White 1984, Zarnowitz and Manuwal 1985, Caton 1996). The various species of cavity nesters all appear to use different microhabitats. Homogenously managed stands are likely to not provide habitat for many species (Hutto 1995). Likewise, any one stand would not be expected to provide habitat for all cavity-using species. Vegetation and snag conditions are naturally diverse across a forested landscape. Maintaining this diversity would provide a wide variety of habitat conditions for bird and mammal use.

Research has shown that for these fires Western larch and to a lesser extent Douglas fir are the snags that will be predominately used by cavity-using birds and mammals in this area. Historically, large-diameter western larch has been harvested because of its high value as a timber commodity and for fuel wood (Hann et al. 1997; as cited in Bate and Wisdom in prep.). In these fire areas western larch is the most valuable species for a suite of vertebrates.

Large diameter western larch is strongly selected by many species of cavity-using wildlife because it provides some of the most suitable nest and roost sites, owing to the characteristics of the wood and its decay patterns (McClelland 1979, Bull et al. 1997). Specifically, western larch is much more susceptible to heart rot making it strongly selected for by a suite of wildlife species. These snags are also known to last longer on the landscape. Large Douglas fir snags provide both nesting and foraging habitat.

Large diameter snags are considered an especially important component of a burned landscape. Cavity-nesters consistently select larger snags for nesting than expected based on what is available. Large snags are used by more species and are much longer lasting, both when standing and after falling. The larger the diameter of the snag, the less the nestlings are crowded and the better they are protected from weather and predators. Large snags are also less of a fire hazard. These snags provide food and shelter to wildlife, fish, and numerous insects, microbes, and fungi that are vital to post-fire recovery and long term site productivity, they help retard surface runoff and help retain and build soil, they help cycle nutrients and water to plants and soil, and snags that fall across streams provide links between terrestrial and aquatic ecosystems (Ingalsbee, no date). Logs also provide critical shade for newly established seedlings during the hot, dry summer months. In addition, log retention may eliminate the need for thinning once the trees reach the sapling /pole stage (Bull et al 1997). Large snags and logs are needed for healthy wildlife and plant populations, fertile soil, and clean water.

Snags and logs with heart rot characteristics are not only important to cavity-nesting birds. A myriad of mammalian species (bats, squirrels, pine martens, fishers, bears) rely on these structures for den and rest sites (Bull et al. 1997). Maintaining these structures even after forests have burned is critical for them because they can persist for so long on the landscape. Salvage logging in the areas containing old-growth characteristics may have long-lasting negative impacts on these species. Although these areas have burned, the decay characteristics within these stands are the ones most likely to provide critical habitat components to many wildlife populations over the coming decades until newly generated stands mature and develop the necessary decay characteristics. Areas such as these may also provide important wildlife corridors once the shrubs and trees regenerate.

Although smaller creatures can use many sizes of dead trees, larger birds and mammals require larger snags. For example, the pileated woodpecker builds cavities that are then used for years by many other species, but it has very low nestling survival in any snag or tree smaller than 20" DBH.

Reserve patches are the only mechanism to assure that wildlife trees will be left standing within harvest units. This is particularly true of the decayed and breaking western larch, ponderosa pine, black cottonwood, and aspen trees and snags that are by nature most valuable to wildlife (Caton 1996, Hitchcox 1996). Reserve patches inside units are also very important in stands lacking classic wildlife trees. Research has shown higher use and nest success in post-fire salvage leave patches as opposed to individual snags left scattered across the landscape. This may be due to the reduction in territorial disputes and less distance to cover within units. Patches left intact along unit boundaries provide more interior habitat, less edge effect, less nest predation, and more effective connectivity between units.

Research has also shown that reserve patches (clumps) get more use (Saab and Dudley 1998, Bunnell et al. 2002). Retaining 15 to 25 percent of the high and moderate snag emphasis units in reserve patches should retain adequate amounts of patches across the fire area. The reserve patches will mainly be positioned around highly valuable un-safe large diameter wildlife snags, riparian/wet areas, and adjacent to unburned or low intensity burn areas.

Cavity-nesting birds are not the only things affected by reduced densities of suitable snags. Commodity values of timber can be reduced by insect damage. Most cavity-nesters are insectivores, and have proven instrumental in preventing, or retarding, local insect outbreaks (Beebe 1974, Otvos 1979; as cited in Bate et al. 1999). Some species of woodpeckers will aggregate in areas where insect outbreaks are occurring, thus accelerating the decline of the insect population. In addition, as foraging woodpeckers remove the bark of beetle-infested trees by chipping and probing, the microenvironment of the remaining beetle eggs and larvae is altered. The remaining eggs and larvae may be more susceptible to mortality caused by parasites and extreme temperature fluctuations. Therefore, by providing cavity-nesters with adequate habitat there can be a benefit from the biological control they provide when present in adequate numbers.

Unsalvaged areas around the units and in roadless areas are expected to provide sufficient habitat for black-backed woodpeckers and other species that rely on dense, severely burned post-fire habitat.

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#### Appendix G: Grizzly Bear Analysis

Amendment 19 to the Forest Plan removed the objective for mapping of grizzly bear habitat components prior to implementation of project activities (Amendment 19 Amended EA, 1995, A-4).

All of the proposed units in MA11 fall into the timber habitat component. Only moderate or high intensity burns or lightly burned stands with high mortality are proposed for harvest so none of the units currently provide cover. Is this true?

### Plan BMA Guidelines

Forest Plan guidelines applicable at the BMA scale deal with cover, security areas/disturbance and habitat diversity. These guidelines were originally developed for harvest of green trees where it was possible to manage for percent cover, distance to cover and habitat diversity. These three guidelines were affected by the wildfire and are not directly applicable to salvage of trees burned by wildfire. Because of the changed conditions following the fire, some of the forest-wide guidelines may not be achieved over the short-term. Moderate and high intensity burned stands will not provide either hiding cover<sup>6</sup> or thermal cover<sup>7</sup>. The above table shows that the McGinniss BMA will not meet the 40% cover guideline as a result of the Robert fire. The others do meet this guideline.

The Plan also includes a distance to cover guideline. The intent of the distance to cover guideline was to ensure that hiding cover is retained adjacent to foraging areas, to reduce mortality risk (LRMR Implementation Note #12). Cover was lost as a result of the wildfire; removal of standing dead trees would not remove hiding or thermal cover, but could decrease visual screening provided by the boles of the trees.

### Post-fire foraging habitat within fire perimeters

Berry production will begin making a significant contribution to grizzly bears within 5-20 years (depending on fire severity) and persisting as an important food source for 30-40 years (Gniadek and Waller, 2003)(Table 173). One study in the North Fork found that shrubs that provide key grizzly foods were higher on sites burned by wildfire 35-70 years ago than compared to undisturbed old growth forest (Zager 1980, Zager et al, 1983). Another study on the Flathead (Martin 1979) found that mature stands or stands that burned 60 to 100 years ago were unproductive. Berry production increased if forested areas with some huckleberry plants, on mesic northern or eastern aspects were burned by wildfire 25 to 60 years ago.

**Table 173. Seasonal Huckleberry Availability by Vegetation Class**

Vegetation Class	Spring	Summer	Fall	Rationale
Bare ground/rock	x	x	x	This category includes slabrock, some avalanche chutes
Grass/forb	x			
Harvested non-stocked	x	x	x	May get some fall use of berries where shrubs have regenerated
Immature/all			x	May get some fall use of berries

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<sup>6</sup> Hiding cover is vegetation capable of hiding 90 percent of an adult grizzly bear at a distance of 200 feet.

<sup>7</sup> Thermal cover is vegetation and/or microsite conditions that enable the bear to moderate ambient air temperature (LRMP Implementation Note #7)

Vegetation Class	Spring	Summer	Fall	Rationale
species				where shrubs have regenerated
Immature/pole/lp				
Immature/pole/non-lp			x	May get some fall use of berries where shrubs have regenerated
Mature/all species				
MSS/old growth				
Pole/lp				
Pole/mixed			x	May get some fall use of berries where shrubs have regenerated
Pvt, harvested/non-stocked	x	x	x	May get some fall use of berries where shrubs have regenerated
Sapling			x	May get some fall use of berries where shrubs have regenerated
Seedling			x	May get some fall use of berries where shrubs have regenerated
Shrub/hardwood			x	May get some fall use of berries where shrubs have regenerated
Water				

## Robert

In this proposal, there are portions of three helicopter units that are located in security core (units 320, 321 and 323 for a total of 99 acres). Due to the isolated settings and winter logging difficulties, these could not be winter logged. It is estimated that it would take 5 days to harvest these acres.

### *Number of logging and hauling days by logging system (M. North 4/9/04)*

- Helicopter = 73 days
- Skyline = 90 days
- Tractor = 67 days
- Total = 231 days
- Assume that skyline and tractor could occur concurrently, helicopter would not occur at same time (safety concerns) for a total of 163 days.

## Wedge

In this proposal, there are parts of 34 units that are in security core, for a total of 793 acres. Of this, about 343 (or 43%) could not be winter logged due to winter helicopter yarding difficulties and avalanche chutes above the road. The remaining 450 acres could be winter logged. It is estimated that the units that could not be winter logged would take 24 days to harvest.

### *Number of Logging and Hauling Days by Logging System (M. North 4/9/04)*

- Helicopter = 61 days
- Skyline = 37 days

- Tractor = 190 days
- Total = 288 days
- Assume that skyline and tractor could occur concurrently, helicopter would not occur at same time (safety concerns) for a total of 251 days.

### Timing of project activities

The revised 1989 Biological Opinion on the Forest Plan recommended a “3&7” rule for MS 1, that would guide activity scheduling by BMA. The “3&7” rule refers to human activities, especially timber sales, within BMA’s that last longer than 30 days can only occur for a maximum of three consecutive non-denning years and then rest for seven. This, in theory, assures that only one litter of cubs out of a 10-year period would not get familiar with the mothers home range because of displacement. This rule is to be used until security core areas as per Amendment 19 are identified and effective on a site-specific basis (Moose BA, 2002).

Criteria for Management Situation 1 is to limit sale activities to no longer than three consecutive years (LRMP Implementation Note #12).

There was a significant amount of human activity during fire suppression efforts in the fall of 2003 and continued activities are scheduled to occur (roadside hazard tree salvage, mushroom harvest, road decommissioning etc). This would leave only one non-denning season of salvage logging and related activities, to meet the “3&7” rule.

### *Project Activities*

- Salvage and rehab – could begin in Nov/Dec 2004 in some areas, but most likely to start in 2005 and be a three-year sale.
- Planting/reforestation – begin in 2005 until sometime around 2009

### *Road Management Strategy*

Road management activities – gate and berm installation in 2005, road decommissioning dependent upon funding

- Possible Mitigation
- Winter logging – see above for winter logging in security core
- Summer logging in security core – make adjacent security areas available
- Canyon-McGinniss and Lower Whale (where not meeting A19) – 3&7 Rule. Fire suppression activities in 2003, mushroom harvest, BMP’s etc in 2004, begin salvage in 2005. Prioritize these subunits for initial harvest.
- While intensive harvest is going on in one drainage, temporarily close roads in adjacent drainage for security

### Robert fire

#### Canyon-McGinnis Subunit

Road #	# miles	Proposal	Notes
1679	2.9	Change from closed yr long gate to closed yr long berm	
1688	1.9	Change from closed yr long gate to closed yr long	

Road #	# miles	Proposal	Notes
		berm	
1688A	1.05	Change from closed yr long gate to closed yr long berm	
1688B	0.68	Change from closed yr long berm to closed yr long gate	
10755	1.8	Change from closed yr long berm to decommission	
10756	0.68	Change from closed yr long berm to decommission	
1670	0.37	Changed from closed yr long gate to closed yr long berm	
316 B	1.6	Change from open seasonally to closed yr long berm	
5225	0.78	Change from closed yr long berm to decommission	
5225	4.21	Change from closed yr long gate to decommission	
5274	0.07	Change from open yr long to closed seasonally	
5295	2.59	Change from closed yr long gate to decommission	
5295A	1.45	Change from closed yr long nat rev. to decommission	
5295B	1.69	Change from closed yr long gate to decommission	
5295C	0.63	Change from closed yr long gate to decommission	
648A	0.57	Change from closed yr long berm to decommission	
803	3.56	Change from open yr long to open seasonally	
803G	0.32	Change from open	
9898	0.71	Change from open yr long to closed yr long gate	
9898A	0.12	Change from open yr long to closed yr long gate	
9898B	0.44	Change from open yr long to closed yr long gate	
9898C	0.10	Change from open yr long to closed yr long gate	

## Wedge Canyon Fire

### Lower Whale Subunit

Road #	#Miles	Proposal	Notes
70701	2.4	Change from closed year long signed to closed yearlong gate	
9805	0.4	Change from open yr long to yr long berm	
5399	2.0	Change from closed yearlong gate to closed yearlong berm	
907	0.8	Change from open yearlong to closed yearlong berm	

**\*Proposed decomm for rds #10863, 10864, 10856B and the north portion of Rd 5399 proposed for closing to yearlong berm has already been included in Hornet Decision (Per Jim Dry 5/14/04)**

## Appendix H: Lynx Habitat Analysis

Vegetation information from Class Name category from the STRU coverage was used to identify non-habitat, currently unsuitable habitat, foraging habitat, and denning habitat.

Classes and habitat assignments are shown in Table 174 below.

**Table 174. Lynx Habitat Classes and Habitat Assignments**

Class	Non-habitat	Currently unsuitable	Foraging	Denning	Rationale
Bare ground/rock	x				Non-habitat
Grass/forb	x				Non-habitat
Harvested non-stocked		x			Will move into foraging habitat as stand is regenerated
Immature/all species			x		Understory species provide cover and forage for snowshoe hares
Immature/pole/lp		x			Understory structure is lacking
Immature/pole/non-lp			x		Understory species provide cover and forage for snowshoe hares
Mature/all species			x	x	Understory species provide cover and forage for snowshoe hares. Overstory provides downed logs for denning and habitat for red squirrels.
MSS/old growth			x	x	Understory species provide cover and forage for snowshoe hares. Overstory provides downed logs for

Class	Non-habitat	Currently unsuitable	Foraging	Denning	Rationale
					denning and habitat for red squirrels.
Pole/lp		x			Understory structure is lacking
Pole/mixed			x		Understory species provide cover and forage for snowshoe hares
Pvt, harvested/non-stocked		x			Will move into foraging habitat as stand is regenerated
Sapling			x		Understory species provide cover and forage for snowshoe hares.
Seedling		x			Understory structure is lacking
Shrub/hardwood			x		Understory species provide cover and forage for snowshoe hares.
Water	x				Non-habitat